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A STUDY OF THE DIVISION OF FACULTY TIME IN A DEPARTMENT OF ELECTRICAL ENGINEERING

BY L. S. FOLTZ

Professor of Electrical Engineering, Michigan State College

During the spring of 1927 considerable discussion arose in department staff meetings about maintenance of equipment. It was apparent that some staff members were devoting considerable time to instrument repair and apparatus construction as it was not possible at that time to obtain this service outside. It appeared desirable to make a study of time division and in September all the department members —head, two associate professors, two instructors, and two graduate assistants—were supplied with the form shown in Fig. 1. It was perfectly understood by all that this was no desire on the part of the Department Head to make a showing in total time expended or in any particular activity but that the program should simply be "business as usual" except daily memoranda were to be faithfully kept. Circumstances made it desirable to permit some variation in keeping these memoranda but, in general, they were made at the close of each day.

For a while entries were made by some on the memoranda at intervals throughout the day, but after a few weeks it was found desirable to confine entries to the close of the day. The first apparent result of this time keeping was the revelation of frequent discrepancies between personal impressions and facts. These invited each man to study himself and his program with the result that there was an involuntary but unmistakable change. Competition was not created but apparently each one strove to follow a program which he, himself, could not seriously condemn.

In Table I, Fig. 3, the "Days" include all Saturdays as half days, but no catalog holidays or Sundays are included.

Several special holidays are embraced which tend to make the daily averages a little lower. At the close of each month the reports on Form I, Fig. 1, were assembled on Form II (Fig. 2). Table I, Fig. 3, was compiled from the various summaries on Form II. The average class hours per day per instructor are 2488.5 divided by 189.5 and by 7 which equals 1.87. The normal lecture period is fifty minutes. Two of these instructors were half-time graduate students and if their schedules are considered as equivalent to one of full time the average class hours per day becomes 2.18. These hours were devoted exclusively for two terms to junior, senior and graduate courses, and in the third term only one three-credit Sophomore course was presented.

Other averages are on the basis of seven. The average time per instructor for "Preparation for Class" is 1.16 and for "Grading" is 1.08. Much of the department work is revised each year and problems and quizzes are distributed through practically all courses. The machinery laboratory courses are terminated with individual manipulative and oral quizzes to insure that the necessary skill has been acquired. This requires considerable time at the close of the term, but it surely reveals things that no amount of written reports of experiments can ever show. Under "Interviews" are included inter-department, inter-office, off-campus and student demands. Naturally the last item is, by far, the largest. Regular office hours were kept daily and many additional appointments made. Effort was continually expended to reduce this to a minimum, but the average is .556 hour per day per instructor.

"Office and Administration" comprises a number of things, some of which are not very definite. It does not cover time spent in interviews, but embraces correspondence, filing, ordering supplies, reviewing bulletins, supervising laboratory operation, receiving shipments, and the like. It must be confessed here that this item was sometimes required to cover time which could not be assigned correctly to any other item On a known expenditure of nine hours with only eight accounted for at the end of the day it was considered probable

that the numerous, petty things that had consumed this time could be properly classified under "Administration."

The department maintains a shop in which minor repairs and construction are carried on. Several pieces of equipment have been given to the department but some work was required to put them into usable, laboratory condition. Some equipment was designed and made by the department. All time so expended was entered under "Apparatus Construction."

The item "maintenance" covers instrument repair, switchboard reorganization and shop care. The average time for Construction and Maintenance combined is .61 hours per instructor per day.

Under the heading of "College Meetings" is included the time required in faculty meetings and in department staff meetings. As the former is attended by professors and associate professors only and the latter by the entire department staff, the average here cannot have its usual meaning. The department program called for a staff meeting at four o'clock on Friday, but it was found unnecessary to have a meeting every week. Convocations were called at intervals of several weeks. The average time per week per instructor is 1.9 hours.

Under "Student Activities" is included time involved in Student Branch meetings and fraternity meetings. In early February an Electrical Show was staged and the participation in the preparation and execution of this is shown in the January and February totals in Table I, Fig. 3.

"Graduate Study" applies only to the work of the two graduate assistants who were candidates for the M.S. degree in engineering. There was only one staff member who devoted any considerable time to research. He was preparing a bulletin for the Experiment Station. Some overlapping exists between "Graduate Study" and "Research" as both graduate students pursued advanced work of an investigational nature and I think approximately 40 per cent of "Graduate Study" time might well have been included under "Research" time.

"Professional Study" comprises time spent in reading and preparing technical articles and carrying advanced courses of

FORM I—DEPARTMENT OF ELECTRICAL ENGINEERING

Month of .....19.... Instructor.....

Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total Hours
Classification A																																
B																																
C																																
D																																
E																																
F																																
G																																
H																																
I																																
J																																
K																																
L																																
Total Hrs.																																

FIG. 1—SYMBOL TABLE FOR TIME SHEET

Symbol	*Activity*	*Symbol*	*Activity*	*Symbol*	*Activity*
A.....	Classes	E.....	Office and Administration	I.....	Student Activities
B.....	Preparation for classes	F.....	Construction	J.....	Graduate Work
C.....	Correcting written work	G.....	Repair & Maintenance	K.....	Research
D.....	Interviews	H.....	College Meetings & Activities	L.....	Professional Reading & Study

FORM II

SUMMARY OF TIME EXPENDITURE OF DEPARTMENT OF E.E.
from .....to .....

Department Member	Class Hours	Preparation for Classes	Grading	Interviews	Office & Adm.	Apparatus Construction	Maintenance	College Meetings	Student Activities	Graduate Study	Research	Professional Study	Total Hrs.

FIG. 2

TABLE I

Totals for the Department

	Class Hours	Prep. for Class	Grading	Interviews	Office and Adm.	Apparatus Constr.	Maintenance	College Meetings	Student Activities	Graduate Study	Research	Professional Study	Days	Total Hours	Average per member	Av. daily hrs/member
September	127	81.5	25	20	108	8.5	56.75	21.5	4.5	120.75	10.5	24	11	611	87.3	7.9
October	293	199	191	66.25	164.75	42.5	51.5	44.75	25	396.5	48.5	64	23.5	1586.75	227	9.65
November	247	175.25	227	88	145.25	7.5	51.5	80.75	26	338	5.5	139.5	21	1531.25	219	10.4
December	153	88.75	193.5	57	145	83.5	48.25	43.5	2.5	106	1.5	48	12.5	964.5	138	11
January	346	218.25	68.25	63	182.5	51.25	53.25	44.75	65	167.5	36.5	101.5	23	1397.75	200	8.7
February	344.5	193	176	77.75	137.75	3	12	66	60	205	6.5	75.5	22	1362	195	8.85
March	306.5	169.25	268.25	110.75	143.75	42	13.75	26.5	9.5	291.5	7	107.25	18	1495.5	214	11.9
April	266.75	229	72	100.25	136.75	43.5	24	44.25	9	273	6	152.25	23	1355.75	193	8.4
May	283.5	187.75	108.25	107.75	165	69	32.75	32.75	13.25	338.5	2.5	118.5	24	1458.5	208	8.65
June *	117.25	50.25	104.75	47.75	127	12.25	21.5	55.25	3	22	.5	37	11.5	598.5	85	7.4
Total	2488.5	1543	1434	738.5	1455.75	443	365.25	460	217.75	2258.75	125	867.5	189.5	12361.25		Av. =9.285

* The records for December and June are incomplete due to the loss of a part of the memoranda of one graduate student.

Fig. 3

study. Encouragement has been given to all staff members to pursue advanced courses in mathematics, physics, etc., as it is beneficial to all concerned. The average time for "Professional Study" is .655 hour.

The "Average Daily Hours per Member" for the entire time is 9.285, which is an interesting fact in connection with the statement of a prominent educator to the effect that education is a preparation for leisure. The record is incomplete as it does not show the time from September 1 to 19, which was devoted to construction and repair. During the summer of 1927 the department staff was engaged in supplementary work as follows: one instructor spent two and one half weeks on a special motor test and one and one half weeks construction apparatus; the other instructor devoted eight weeks to research; one associate professor attended the Summer School of the Massachusetts Institute of Technology; the other was for eight weeks on the engineering staff of a city electric company; the department head devoted five weeks to the study of the organization, problems and engineering methods of a large power corporation.

The material here presented shows what actually happened except for the two lost monthly records of one graduate student and is a starting point for the study of time division in engineering instruction. The staff as a whole showed keen interest in the study and cooperated in a most commendable manner for which I here express my hearty appreciation.

INVESTIGATION OF THE LAW OF CONSERVATION OF ENERGY

BY F. M. WARNER

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Introduction

There are two sources of information available for one who desires to make a historical investigation of a scientific subject. The first source is what I choose to call the primary source, and by it I mean the original article as written and published by the scientist himself. The other source is what I call the secondary source, or it is what some later person had to say about what someone else said.

The secondary source of information, while very enlightening and very essential, is liable to be far less authentic than the primary source. One has to read very carefully and draw conclusions very sparingly from second-hand information. This is due largely to two factors: first, the possibility of different conceptions of terms, such as *force* and *energy,* at different periods of time; second, the possibility of the prejudice of the writer. For example, if we want to know to whom to give the credit for the discovery of the mechanical equivalent of heat, we may find that a German book will tell us it was Mayer, a French book will tell us it was Sequin, a Danish book will tell us it was Colding, and an English book will tell us it was Joule.

If it were possible to go to the primary source of information, the original papers presented by these men, it should be easier to draw conclusions, provided that the reader has a sufficient amount of scientific knowledge to read the article intelligently and eliminate false assumptions.

However, here again we are confronted with the difficulty of having to read translations of papers originally written in Latin, German or French and the free translation itself carries

the personal equation of the translator and reduces it to a secondary source.

With the above in mind, I have tried wherever possible to use the primary source of information and to weigh carefully all secondary sources of information when it becomes necessary to use it. I have used numerous word for word quotations of different statements of laws, etc. This is for the express purpose of giving you an opportunity to sense for yourselves the exact thought which the author had in mind.

Each quotation will have beside it a number, thus (2), which refers you to the bibliography at the end of the paper, where you will find the authority quoted and the source of information for further investigation if you wish.

Terminology

The beginning of the nineteenth century seems to have been a critical time for the two words "force" and "energy." Previous to this time the word "force," in a vectorial sense, as handed down by Newton, was used almost entirely and the word "energy" was seldom heard. Due largely to the experimental work of Joule, Colding and others in determining the nature of heat and its mechanical equivalent, the idea of energy began to come into more general use. In reading the papers of this time, it is exceedingly difficult to determine, in some cases whether the writer really meant force or energy when he really said force. In the case of one writer, the credit due him for this law depends entirely on the translation of one German word, as to whether it really is used in the sense of force or energy.

To further complicate the situation, (and later clarify it) during this transition period from the idea of force to the idea of energy, a new term appeared and was quite generally used. It was called "vis viva" or "living force" and was really a stepping stone from force to energy.

One writer (4), writing as late as 1874, made the following statement: "In recent works the word energy is used to designate active or working force as distinguished from

passive or non-working force. It is in this working condition only that force is conserved."

The conception of the term "living force," as held at that time, seems to be explained best by Joule (5). He argued that a body at rest cannot be set in motion without the application of a force to it; and that, in like manner, after it has reached a state of uniform motion, it will never stop of itself but will continue to move with a uniform velocity in the direction of a straight line until another force acts on it. So far this is just Newton's first law of motion. But he continued as follows: "From these facts it is obvious that the force expended in setting a body in motion is carried by the body itself, and exists with it and in it throughout the whole course of its motion. This force possessed by moving bodies is termed by mechanical philosophers 'living force.'"

On account of this difficulty of interpretation of words and ideas, I will not presume to make an absolute statement crediting any one man with originating the Law of Conservation of Energy. The fundamental principle involved in this law seemed to have been smoldering like a confined fire when, suddenly, it burst forth, like flame, in many different places at about the same time. Practically all of the best statements of this law that I found were made within a short space of fifteen years.

History

The earliest person in history to whom I can trace even the slightest idea of conservation is Galileo (1564–1642) and I only mention him because he was the first to dare to overthrow Aristotle's (384–322 B.C.) law of two thousand years standing and because he was noted for his revolutionary ideas. One authority (1) says: "The idea that energy cannot be created appears to have been familiar to Galileo. There appeared to be many cases in which energy was destroyed, however, and the indications were, in fact, that all mechanical energy is gradually wasted away by frictional losses and by others of like nature." I think the author should not have used the word "energy" when speaking of Galileo. Thus, it seems

as though Galileo had some idea about conservation and the conserving of force or living force, but he was not yet able to account for the disappearance of some of it.

Next, we should recognize Newton (1642–1727) as a substantial contributor to the principle of conservation. After stating his three laws of motion, he gives (2) some corollaries and scholiums. One scholium after the third law is translated (3) literally from Latin as follows:

"If the action of an agent be measured by the product of it's force into it's velocity, and if, similarly, the reaction of the resistance be measured by the velocities of it's several parts into their forces, whether these arise from friction, cohesion, weight or acceleration, action and reaction, in all combinations of machines, will be equal and opposite."

The above scholium of Newton is translated freely by Tait (1831–1901) as follows:

"Work done on any system of bodies has its equivalent in work done against friction, molecular forces, or gravity, if there be no acceleration; but if there be acceleration, part of the work is expended in overcoming resistance to acceleration, and the additional kinetic energy developed is equivalent to the work so spent."

In this free translation, Tait aims to put into language of his day what he thought Newton was trying to say. It may be colored somewhat by Tait's personal views as the Law of Conservation of Energy was established and widely accepted when Tait made this translation. Please keep this thought in mind, then, as you read this further statement by Tait (14) in which he says: "The conservation of energy as regards ordinary mechanics was completely stated by Newton as a corollary to his third law."

The free translation does practically give Newton credit for stating that "work is indestructible." We should also notice that, even in the literal translation, Newton's quantity to be conserved was not one factor alone but the product of two factors, namely, force and velocity. This scholium is an

amplification of the third law which ordinarily conveys the idea of force only.

About 1742 D'Alembert wrote a book (6) in which he made mention of the principle of conservation of "living force." He made the following statement, literally translated:

"If bodies act on each other, either pushed or pulled by cords or inflexible rods, the sum of the product of their masses by the square of their velocities is always a constant; and if the bodies are acted upon by any other effect, the sum of the product of their masses by the squares of their velocities at each instant is equal to the sum of the product of the masses by their initial velocities plus the squares of the velocities which the body has acquired."

He further stated that Huyghens (1629–1695) was the first who made use of these two principles and that Bernoulli was the first who "has been able to see the use of them for solving elegantly and easily many problems in dynamics."

This did not appear to me to be a clear-cut statement of conservation but it was tending that way. I was unable to find any other reference to it. However, this may have started some of the later men to thinking along this line.

So far in history there were two chief obstacles to a better understanding of energy conservation; the first was the fact that there seemed to be a universal belief in the annihilation of force; the second was the fact that the quantity "heat" remained a mystery as far as its relation to work was concerned. Thomson and Tait (7) tell us: "that in Newton's day and long afterwards it was supposed that work was absolutely lost by friction." In most cases of energy transformation, even to-day, we have to account for some loss of energy by explaining that it has been transformed into heat. We can readily see how necessary it is to understand heat and its relation to work in order to even conceive of conservation of energy.

The discovery of the mechanical equivalent of heat came about in the middle of the nineteenth century and seemed to

spring into existence in several different countries almost simultaneously.

Sequin (1812–1880), a Frenchman, published a book (17) in Paris in 1839 in which he described his experiments and set forth his ideas about heat. Some would give him credit for being the first to establish a value for the mechanical equivalent of heat, but others dispute this.

In 1842 Mayer (1914–1878), a German physician, wrote a paper on "The Forces of Inorganic Nature" and, after considerable difficulty, finally succeeded in getting it published in "Leibig's Annalen" (9) in which he announced his heat theory. In 1845 he presented another paper giving his detailed calculation for the mechanical equivalent of heat. He performed no experiment, but his deduction was entirely from a theoretical standpoint. In this paper Mayer said: "During the vital processes only a conversion of matter, as well as of force, occurs and a creation of either one or the other never takes place." Once in this paper he refers to force as "vital force."

While Mayer and Sequin got very near the same mathematical result, later authorities point out that it was only a coincidence and that they both made false assumptions.

About the same time, Colding (1815–1888), a Danish engineer, presented before the Academy of Copenhagen a paper entitled "Theses Concerning Force," which gave the results of his experiments upon heat produced by friction of solid bodies, and expressed the view that the law of Conservation of Force was a general one (10).

In 1843 Joule (1818–1889) read his paper announcing his determination of the mechanical equivalent of heat by experiment.

The above experiments and announcements of their results soon cleared the way for explaining what happens to work supposed to be lost by friction.

In 1847 Joule delivered a popular lecture (11) on the subject "Matter, Living Force and Heat," which was published in the *Manchester Courier* in May, 1847. This address was

given again before the British Association at Oxford and there it went almost unnoticed until Lord Kelvin arose and called the attention of the meeting to its importance. In this paper, Joule first defines living force as previously mentioned in this paper. Here are some of his outstanding statements:

"Experiment has shown that wherever living force is destroyed or absorbed, *heat* is produced."

"The general rule, then, is that wherever living force is apparently destroyed, whether by percussion, friction, or any similar means, an exact equivalent of *heat* is restored."

"In these conversions, nothing is ever lost; the same quantity of *heat* will always be converted into the same quantity of living force."

Thus, we see that, while Joule did not propose definitely the name for the law as we know it now, he certainly did make a clear and definite statement that living force, which means energy to us, cannot be destroyed. I was interested to learn that after this meeting where Joule read his paper, Lord Kelvin told him about Carnot and his thermodynamic cycle.

One month after Joule read his paper, on July 23, 1847, Helmholtz (1821–1894) read an essay before the Physical Society of Berlin. The subject of his paper was "Ueber die Erhaltung der Kraft." It is unfortunate that in the German language the word "kraft" can convey the idea of force or energy equally well. So the title of this paper is sometimes translated "Conservation of Force" and sometimes "Conservation of Energy." I quote the following comment on this paper from the American Encyclopedia.

"The subject was presented with great generality and clearness and had a profound influence in spreading the new doctrine which taught that no energy is ever created or annihilated, but that we have to do merely with endless transformations of it from one form to another."

Helmholtz himself said that his paper was intended to be a critical investigation and arrangement of the facts which bear on this point for the benefit of physiologists. Helmholtz was a military surgeon and only twenty-six years old when he read this paper. Rucker says (12):

"The phraseology differs from that we employ, but the use of terms now regarded an archaic is not due to any mistiness of perception. Write energy here and there for force, potential energy for tension, as defined in the essay, assume our fuller knowledge of the results of experiment, and the whole might have been written yesterday instead of fifty years ago."

Assuming that "kraft" and "living force" both imply energy, we have two remarkably clear statements by Joule and Helmholtz regarding the conservation of energy. Both writers met great opposition in getting their papers printed and in reading them. Since their presentations were only a month apart, it would be impossible to make a definite statement as to who was ready first to make his statement in public.

The following ten years did not seem to witness so much discussion about this great principle. However, in 1857, Faraday (1791–1867) published in the *Philosophical Magazine* (13) an article entitled "Conservation of Force." He modestly announced his law, saying that he had nothing to go on experimentally, but that it was just his idea and that he thought it was time some definite law was stated. In this article Faraday used the word force as a tendency of a body to change its place. He also defined force as "a cause of physical action" and used it like he would the force of gravity. The trend of this article may be pretty well acquired by reading his definition of "inertia." Faraday said: "We know not the physical condition or action from which inertia results but it enables a body to *take up* and *conserve* a given amount of *force* until that force is transferred to other bodies or changed into an equivalent of some other form . The progress of the strict science of modern times has tended more and more to produce the conviction that force can neither be created nor destroyed."

This sounds as though Faraday was really thinking about living force, although he does not mention the term and his idea of force seems to be of one dimension only.

Two years later, Rankine (1820–1872) took exception to the article by Faraday and wrote, in the same magazine, an answer to Faraday. (15) His article was entitled "Conservation of

Energy" and in this article he definitely stated his law by the name it is still known. I will quote four of the salient points in his article.

1. "It is certain no law of Conservation is applicable to the *tendency* of a body to change its place nor to any other tendency."
2. "The quantity whose amount is conserved during all the mutual actions amongst a system of bodies, is always the *product* of two factors; when one of these factors is a magnitude of a tendency toward change of a particular kind, the other factor is the magnitude of the change thruout which that tendency is capable of continuing to act."
3. Since force has been used to denote a tendency, Rankine objects to the term "Conservation of Force." He says: "A phrase should be adopted in its stead about which there is no ambiguity, such as 'Conservation of Energy.'"
4. "The principle of Conservation of Energy may thus be stated: 'In any system of bodies, the sum of the potential and actual energies of the bodies is never altered by their mutual actions.'"

The wording of this law as stated above is not quite as comprehensive or all-embracing as we think of it now. By reading this law, we are not reminded of any magnetic, radiant, electrical, chemical energy or heat, although Rankine might have intended these to be included so far as he knew them. I do not think Rankine's statement of the law is as good as Joule's statement and it came twelve years later. However, Rankine seems to be the first to propose the name of the law of Conservation of Energy as we know and still use it to-day.

During the following years, I found very little further reference to this law, which indicates that it must have been rather generally accepted. The International Encyclopedia states that "by 1860 the generally concordant results had not only conclusively demonstrated that heat is a form of energy, but they had also demonstrated the Conservation of Energy."

In 1879 Thomson and Tait (7) restated this law as follows:

"The whole work done in any time, on any material system, by applied forces, is equal to the whole effect in the forms of potential and kinetic energy produced in the system, together with the work lost by friction."

Each textbook has a different wording of the law but all are trying to say, in substance, that energy can neither be created nor destroyed. Thus do we have a law similar to the Conservation of Matter. We therefore have the two most fundamental laws of all science expressing identical facts about the two fundamental basic ideas of science, namely, matter and energy.

Reversibility and Dissipation of Energy

While the Conservation of Energy law was practically universally believed after 1860, there were still a few things about it to be explained. It was supposed to assume that any form of energy could be transformed into an equivalent amount of any other form of energy. But it was soon discovered that this was not possible. Joule's experiments tended to study the conversion of mechanical energy into heat and he established a very accurate figure. Thomson, Rankine and Clausius tried to deal more with the transformation of heat back into mechanical energy, and they discovered that they could never get all the heat energy completely transformed. It was Thomson (Lord Kelvin) who studied this phase more carefully and who wrote more about it (18). He showed that the transformation of energy is not always a reversible process and also wrote about the Dissipation of Energy.

Lord Kelvin said: "When heat is created by any unreversible process (such as friction) there is a dissipation of mechanical energy and a full restoration of it to its primitive condition is impossible. When heat is diffused by conduction there is a dissipation of mechanical energy and perfect restoration is impossible."

What, then, becomes of the energy that is constantly being transformed into a form from which it can never be returned? If the sum total energy of the universe is a constant and more of it is constantly becoming unavailable, the available energy must naturally become less, unless there is some way for the unavailable energy to be returned through nature which does not seem to be satisfactorily explained to date.

Daniels, in his Physics (19), writes as follows: "The energy of the universe is a constant amount; some of it is available and some is non-available; the former is in every phenomenon somewhat diminished but never increased; the non-available energy is constantly increasing. Hence the available energy of the universe tends to zero. Lord Kelvin expressed this by saying that the *Motivity* (the proportion between the theoretically available energy and the whole energy) of the universe tends to zero."

Assuming that the last statement is true and providing that we could plot a curve having as ordinates the remaining available energy of the universe, that curve might approach zero in more ways than one. It might be asymptotic or tangential like a sine curve with transposed axes. Based upon the present state of the art, the curve now looks like it might be asymptotic and practically all writers I have read concur in this opinion.

However, would it be too much of a stretch of our imagination, or would it be consistent with this great law of Conservation of Energy to suggest that I believe that poor, weak mankind still has a few things to learn about science, and that, before the available energy of the universe ever reaches zero, he may yet discover how to transform unavailable energy back and make it available, even faster than it is now said to be dissipated. In other words, I suggest that it might not be impossible (although it seems now to be highly improbable) for this curve to be of a sine nature with transposed axes and start to go up again before it even reached zero or became tangential. I have found one writer, at least, who concurs in this opinion, (20) and who thinks the sine curve is not impossible.

To me, conservation means saving and dissipation means wasting. It seems inconsistent for a person to believe in both conservation and dissipation at the same time. This may be best explained by a crude illustration. Suppose I put what money I can save into a hole in the ground many miles deep.

As long as I hold the thought that it is possible for me to recover that money sometime, it seems proper for me to think of it as being saved. But as soon as I admit that it is an absolute impossibility for me ever to recover that money, I would be foolish to even mention that I had saved it. In other words, it seems incongruous to consider the money saved if it is absolutely and perpetually unavailable.

Then, I ask, why do we say we save or conserve energy when we put it where nobody can use it or ever will use it? My only answer to this is that if we say we believe in the Conservation of Energy, that should carry with it the belief that there is no permanent Dissipation of Energy, or that no energy is unavailable except temporarily, due either to our lack of knowledge to make the process reversible, or to the time not being ripe for nature or natural sources of energy to reverse the process.

Conclusion

The retrospect over the period of time in which this fundamental law was being produced has been interesting and instructive to at least one person, *i.e.*, the writer. While I realize that this paper will not add anything to modern scientific knowledge, it is at least interesting to see what the other fellows had to go through and to see what we owe them. I am impressed with the difficulties which had to be overcome by all these men to establish for us the principles which we now believe in. It causes me to inquire whether we do not tend to take too much for granted instead of reaching out for more new ideas. Possibly we could help to plot the available energy of the universe in a sine curve.

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WANTED: AN UNPRACTICAL EDUCATION *

BY JOHN C. PARKER

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I have a son who is nearly thirteen years old. You and I have a common problem with relation to that boy, I, as the parent, you, as possible teachers, or if a former teacher may momentarily revisit the pale glimpses of the moon, I will identify in my own person both the teacher's viewpoint and that of the parent. Since, prior to my seven-year period as a teacher I was an employer and have returned to that relationship, may I try to talk in all three capacities? Again as a workman who has been somewhat educated, may I talk as well from the point of view of that least considered victim in the process, the graduate himself?

I believe that the true interests of all parties to this process, the student, the parent, the employer and the teacher—significant in the order named—are identical, that what is broadly good for one is to the best interest of all.

For this boy of mine, for his greatest usefulness in life and for his personal happiness, for the gratification of my hopes and ambitions for him, for what he can do in the world, serving the kind of employer I hope he will have and for the biggest satisfaction of the teachers under whom he may elect to study, I hope he can be given through the years of high school and college the sort of a thing that is commonly called an unpractical education.

I am basing this hope on the firm conviction that the kind of stuff that is usually understood as practical is actually most unpractical and that the kind of thing that may be styled useless really has the highest utility.

There is a persistent demand from parents and employers, from trade associations and from donors, from the makers of

* Presented at a meeting of the New York-New Jersey Section of the S. P. E. E., December 8, 1928.

curricula and from the youngsters themselves whether in primary, secondary or university institutions, that pupils be given something useful, meaning thereby, I suppose, something with which they can earn a living.

Insofar as this is in protest against a snobbish classicism, I sympathize with it most fully. I have little patience with the idea that subject matter loses its cultural or educational value merely because it is related to an honest world of affairs, of physical fact and of live processes. On the contrary vital and vigorous education can come only through being related to life.

My complaint would be rather that training youth to earn a living is not education at all, second, that a specific training may keep the youngster from earning the best kind of a living and third, that it can't be done in school anyhow.

I assume that it is not a legitimate function of educational institutions to take the funds of society as a whole to fit certain particular individuals to earn a living through advantage not universally enjoyed. On the other hand I conceive the real purpose back of state support, back of the social support of education to be the fitting of students to live richly and fully and to contribute most broadly to the welfare of the social group who have paid for their education.

Whether this be the true purpose of education or not, for this boy of mine I am considerably more interested in whether he shall be able wisely to spend and fully to enjoy what he earns than I am in the amount of those earnings or the ease with which they are acquired.

I would infinitely prefer that education fit him for happiness and decency in poverty than for wealth acquired through the sacrifice of himself and his character.

Grant that I am wrong in this. I know perfectly well that his young mind will absorb only a certain amount and that if particular training in a too narrowly defined art be given him, life may perpetrate one of its ghastly jokes in presenting narrow opportunity along that line and big opportunities in fields for which he has not been trained at all.

Anyone who has lived in an actual world has seen literally

thousands of cases in which men, young and old, have been trained in an art which has become obsolete and have seen the victims forced to degrade their social usefulness through lack of adaptability to changed conditions. We have seen cases in which the field chosen by parents or advised by teachers or selected by the students have not in the sequel proven what they were thought to be and we have seen men left standing in forward moving organizations merely because they had not that breadth of fundamental training which would enable them to move with the current.

Granted then that just so much can be accomplished in sixteen or eighteen years of formal schooling, I want those things to be of such a character that my son can use them in whatsoever field of human endeavor may be suited to him and may offer itself; and if he chooses some particular range of studies I want to be sure that aside from and superior to the subject matter those courses shall have a content which shall do things to him in the way of developing intellectual vigor, standards and ideals, and mental processes which can be brought to bear on any of the problems of life.

I hope he will be interested in pure mathematics and I don't care whether he is as ignorant as his dad concerning the equation to or the shape of a lemniscate; that really does not matter after all and the world probably would have been quite as rich had the curve never been discovered but if the youngster meets it I want him to be able to see some sheer physical beauty in the grace of the thing. I hope that his imagination will be arrested when he discovers that the shifting of the constants in the equation of an hyperbola creates a beautiful and moving series of exquisite curves all tied together at infinity, passing through two intersecting straight lines and then filling voids in unoccupied quadrants. Here will be something that will arouse his imagination, that will teach him that order which is heaven's first law, which will enable him to project his mind beyond the immediate and the particular into a wondrous field of generalized relationships.

These values in his mathematical studies will be as great whether he follows the law, preaches the gospel, administers

to the physical needs of the sick or runs a merchandising establishment.

And if he elects to take a course in engineering I hope that he will bring out of it a knowledge of the conduct and behavior of materials and of the processes by which industrial human progress has taken place, which will enable him to understand a life which has its very foundations in the creative works of organized industrial society. I shall not, however, be very much concerned with whether he has been taught some particular form of valve gear or somebody's pet formula for buttoning up a riveted joint.

Let me at this point say just one word about the real values in all these courses in pure and applied science. They deal or should deal with objective truth rather than with speculation or opinion. If biggly taught they will promote a higher type of imagination than ever could be had from subject matter that concerns itself only with speculation. It is a finer vision that can constrain itself to things proven and learn from *them* the great generalized truths of the universe, that can perceive the romance back of the lifting of a continent from ocean bed—this is an infinitely finer type of vision than the hot house variety that can find beauty and romance only in artificiality be it never so exquisite.

But beyond all this, our scientific and professional courses have a tremendous advantage in their objective character. Being that, if they do no other thing, they should develop love of the truth, not moral integrity alone but intellectual candor which in my mind is pretty close to the beginning and end of all the virtues. If you teachers will do some things of this sort for my son I know that he will approach life unafraid, that he will not try to fool himself into believing that his selfish desires are the will of Jehovah or that he is more important than his fellow man.

If imagination and integrity can without preaching be developed in our professional courses such education will be the more persuasive because it has been borne of things of which it might not superficially have been suspected to be germane.

I have suggested that no school can give a narrowly practical training. Anybody who knows both teaching and practice knows this full well. The life of the student is artificial and should be. He is forced to march more or less in lockstep with his fellow students through a more or less definitely laid out curriculum. Life does not work that way. Individuals in the ever changing exigencies of a real world forge ahead or drop behind or move side by side up to a point of divergent influence. Decent or brutal competition exists. Some assume leadership—others follow. The whole atmosphere of school and of life is necessarily and essentially different.

Practical design concerns itself with intricately organized social and economic processes, the most trifling engineering device must be designed for production under the peculiar conditions and restraints of an actual factory, to be marketed through real and frail human channels and to be used by actual ultimate consumers. Ninety per cent of the problem of a designer lies in the wise determination of these and other constraining facts, in the selection of the field which he shall endeavor to cover and in the satisfaction of others that his determinations are sound. His work is primarily in the discovery and statement of his problem. No school can ever hope even remotely to assemble an environment of actuality about any problem, of necessity it must formalize an artificial problem if indeed it would avoid giving the student a most unpractical impression that his subsequent problems in actual life will come to him all neatly wrapped up in a package, labeled and classified.

Grant even that real problems could be introduced within the school walls, the question yet remains, what value attaches to the specific practical information that is got from solving them. Any professional work is a live thing, related to rapidly changing life. The ink will not have time to dry on the student's diploma before the quantitative facts, social emphasis and the problems that are crying for solution shall have changed. What point then in teaching the youth formulae, data and processes howsoever accurately if necessarily obsolete. This is a most unpractical practicality.

But, you urge, the world won't take our goods unless we purvey to its needs. Industry insists that we must turn out our graduates to its end. Maybe so; I cannot ask you to take my personal wishes as an index of what the world at large wants, but for what they are worth let me state them here. As an administrator, I am not particularly desirous of having young men come to us full of facts which would be slightly interesting if they were right but which, in the main, will have to be unlearned because they just are not so. If a teacher can get hold of the facts of my industry in order to communicate them to his students he will have to get hold of those facts from the industry itself and so, if you please, the student will be merely bringing back to us, a little late and a little shop worn, the specific facts that have arisen with us.

Put it the other way round. We will get stuff thoroughly codified into a practice which can be carried out by routine workers long before it can be formulated into school instruction. We want something very much bigger than this. We need young men of keen perception, sound and orderly analytic ability, of sympathy and of understanding to analyze the facts as they arise from day to day, to draw new conclusions from them, to generalize these conclusions into canons of the truth and to devise new practicalities of putting them into effect. This sort of thing, in that it pays big dividends or increases the social value of our service, is practical with a vengeance and it is the sort of thing for which every industry and every profession and every art is ahunger and athirst whether it recognizes the need or not.

Let it be thoroughly understood, too, that the teaching of practice may be the teaching of obsolete or bad thnigs. All practice contains some elements that are not worthy to be continued and some practice is positively wrong. The major part of the life work of any man must be to create new practice to correct and to improve what exists.

The teaching of practice tends to the continuation of evils rather than to the type of mind that makes for betterments.

None of the world's great discoveries and inventions has come by the process of yielding up, like a squeezed sponge,

those things which the mind has soaked up but rather, as the result of critical and creative and impatient mentalities.

What little of practical training may be necessary can very quickly be grasped by a young man fundamentally and thoroughly educated—through his contacts in the only school of practice—life itself.

I am telling you of the need of my industry and of my profession as I see it and telling you of what I personally would ask of the teaching profession. Is it a practical program of education to make education unpractical? Will the world accept the goods which the teacher is offering? My answer must be the very practical one of experience during seven years as an educational administrator. During the period to which I refer, the staff, of which I was in charge, endeavored solely to give a broad and fundamental education, concerning ourselves much more with what we did with our students than with what incidental facts they accumulated. This was done in the face of criticism from other teachers, complaint by the students and insistent practical demands from industry. The parents happily left us alone. I say this program was adopted in the face of criticism; that was initially. Enrollment dropped and gradually mounted considerably above what it had been before the elimination of every practical course offered by our department. We did not at any stage of the game have any difficulty in finding places for our students with the people with whom we wanted them to connect, indeed during the lean years of 1921 and 1922 the difficulty was rather to keep the youngsters from being inflated by too much solicitation on the part of employers who had had samples from previous crops. Six years later I find the boys who went through that kind of a process, many of them occupying rather unusually distinguished positions in industry and am glad to say that I have been able and willing to use several of them in my own organization.

What industry will accept is altogether a question of having faith in the program and the courage to carry it through.

And now for the teacher himself what shall we say. Must he always listen to the cheap deprecation of his calling; shall

he concern himself with the stupidity of a world that damns with the label "pedagogue"; is his way out to attempt to do something practical and useful, to go through the motions of practicality necessarily with his tongue in his cheek the while or will he recognize that it is better to teach well those things that can be taught than to teach badly the things which have a glamorous glitter on the pages of a college announcement. Can he not—*must* he not—recognize that it is more important to educate and to develop men for life than it is to satisfy the whims and caprices of students or of possible employers or even to offer those courses which a president or a board of trustees ask of him as a cheap form of parlor trick. Again may one be just a little practical in discussing this unpractical subject. One hears much of the poor pay that is given to the teaching profession. In part this is right and in part the just suffer with the unjust but I rather suspect that were our schools to have more faith in education and to be less compliant in giving functional training they would deliver goods of a kind that the world really wants and that the natural law of supply and demand would insure vastly more adequate compensation for teachers as teachers than it will give to school men who make a most inadequate pretense at being anything but what they are.

And so it is gentlemen that as the victim of a university education, as an employer, as a father and as a teacher I am putting out my advertisement calling for an unpractical education in the full assurance that the right kind of unpractical education is the only kind that is most practical and just in proportion to the shortness of the period that the individual can spend in school would I lay more stress on his getting from school those values which can be had nowhere else, so that the least favored shall have the assurance of a more nearly even start with those who can spend more time and perhaps in the graduate school develop particularized training.

All of which is very unpractical unless one suggests an answer to the question "What are you going to do about it?" Well I have no faith that these remarks of mine are going to cause boards of trustees and curriculum committees the coun-

try over to change their curricula over night but I have a hope that those of you who have some faith in the theoretical aspects of education and who have somewhat of a pastoral interest in the boys committed to your charge will recognize that however practical the educational machine in which you are a cog, you can individually so direct the conduct of your own courses that your students in later life may arise and call you blessed for having given them something useless—something on which to build for themselves.

"US ENGINEERS DON'T NEED NO ENGLISH"

By JAMES C. PEEBLES

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During an open hour a number of sophomores are gathered in the drafting room, making more or less successful efforts to solve some problems in the next day's calculus lesson. So far as unit output, that is, problems solved per student, is concerned, a "math bee" like this is unusually productive of better results than when the work is done individually. Everybody has all the easy problems, but nobody has the hard ones. These are solved only by the solitary thinker, undisturbed by the rabble. From a "bee" like this the gang gets more honey than it deserves, while the thinker very likely gets stung.

Suddenly one student, having collected his unearned increment of honey, slams his book shut and rises from his chair with an air of finality. "I certainly hate these kind of problems, and I ain't going to waste any more of my time on them."

In addition to an erroneous estimate as to the value of his time, this young man is guilty of two assaults on the mother tongue. One is an inexcusable solecism often used by those who should know better, the other a plain vulgarism never heard among cultivated people. Speech like this is the despair of the teacher of English. The lad may know every rule in the grammar, and recognize his errors when they are called to his attention, but still he continues to make them. It is the result of slovenly mental habits usually formed very early in life from bad example at home or elsewhere. Against such a heritage school and college struggle in vain.

In the recitation class in physics sits a young fellow who is finding the course in engineering a bit too much for him. He has been struggling desperately to retain his footing

amidst a flood of physics, mechanics, mathematics, but he is being carried slowly beyond his depth. He has tried to solve problems involving zero and infinity, but he feels that he cannot master all that lies between, certainly not in a single semester. When the professor suddenly shoots at him the question, "What is a vacuum?", he dives like a frightened teal into the flood of facts about him and comes up with this: "A vacuum is where nothing fills all space."

Here is a lad who knows practically nothing about what he is asked to define, and of course his answer is meaningless. If one would speak or write clearly and convincingly on any subject he must first make himself complete master of that subject. The change from a mental to a spoken picture is seldom accomplished with an efficiency of one hundred per cent; there is nearly always a loss in the mutation. If the mental picture is not clear and distinct the spoken or written likeness is very likely to be nothing but a blur. Sometimes, of course, a very clever speaker who has only a superficial knowledge of his subject can trace, in beautiful words and phrases, a feathery arabesque which is highly entertaining to his hearers. They admire his artistry but they carry away with them no enduring memory of what he said. For most of us precise knowledge is the great prerequisite without which clear written expression is impossible.

The class in valve-gears has just finished a written lesson in which this question appeared: "Describe the construction of an eccentric on a steam engine and explain its function." Later, as the professor is reading the papers, he finds this answer to the above question. "An eccentric is a thing on the shaft of the engine to move the valve with. It is held on with a strip of metal in a slot, or with a bolt, and it slips around as the engine turns. If it slips too far the engine stops or runs away, as the case may be."

The professor is in a tolerant frame of mind, and he recognizes the germ of an idea in what the student has written. He reads the answer several times, but finally, more in sorrow than in anger, he applies the blue pencil, thinking as

he does so: "Such an eccentric never was on land or sea." Stripped of its poetic expression and reduced to the language of the engineer, the professor's comment simply means, of course, that such a device was never used in stationary or marine practice.

In addition to very meager information on his subejct, this student lacks the mechanics of adequate expression, the words and phrases in which to clothe his ideas. An eccentric might have been called a device, a piece of mechanism, a part of the valve gear, but "thing" is not very expressive. He has not learned that a strip of metal in a slot is a key, and instead of bolt he means set-screw. His ideas as to how the eccentric slips are entirely chaotic and the whole dictionary would not help him here.

An inadequate equipment of words is a common, but not a serious, cause of poor speaking or writing. It is not serious because it can be overcome, and usually is, if one is observant in reading and in conversation. Seeing and hearing words used correctly can hardly fail to increase the vocabulary, except in the case of those hopelessly unobservant and lazy.

Several students are just about to leave Machinery Hall, their minds intent on lunch at the fraternity house. One of their number, however, declines to go with them, and turns toward the library. "No lunch for me today, fellows; I must finish these notes and get them in to the professor of cold storage by one o'clock, or I'll flunk the course." So he goes to the library and writes frantically during the noon hour.

When the professor reads these notes prepared by the lad with the high-speed pen, his eye falls on this sentence: "Cold storage has made it possible to freeze meat and is responsible for the high price of eggs."

In the course of his lectures the professor had stated that mechanical refrigeration and cold storage had made possible the frozen meat industry, as a result of which almost the entire world had become a possible market for fresh meats prepared in America. Later, in discussing some of the economic results of refrigeration and cold storage, he pointed

out that it had greatly reduced the seasonal price fluctuations in many commodities, notably eggs, by providing a market in times of large production, and a source of supply when production is low. Out of these two unrelated observations of the lecturer, the student had evolved one rather remarkable sentence.

This is another example of a writer with very little knowledge of his subject, but it also shows a complete lack of logical arrangement. Unrelated statements are tied together with a conjunction, but they served no useful purpose and the result is nothing but confusion. No capable engineer would start to build a bridge until it had been planned to the last detail. He will often, however, start to write some important document with no plan, no logical arrangement, in mind. He may be a master of his subject, he may know and observe all the rules of grammatical construction, the entire verbal resources of the language may be at his disposal, and yet the result is little better than a hodge-podge. Engineers sometimes wonder why they study logic, but if it teaches them logical sequence in their spoken or written treatment of a subject, it comes close to being the most valuable subject in the entire curriculum.

The Alumni Executive Secretary, employment agent for the university, replaces the telephone receiver on the hook and turns again to his overloaded desk. "There's a good job for some young graduate; the particular course that he took doesn't matter much, and he need not have been an 'A' man in his studies; but he must be able to write a good letter, he must know how to present a proposition, orally or in writing, in an attractive and convincing way. Where am I going to find such a young man?"

If students of engineering could only realize the vital importance to them of a command of good English, could understand what a large factor it is in nearly every substantial success, they would soon forget the foolish notion, expressed by many a rebellious student that "us engineers don't need no English."

HOW ENGINEERING INSTRUCTORS BETTER THEIR PROFESSIONAL STANDING*

BY FERRIS W. NORRIS

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Learning is the result of activity on the part of the student. A student tends to repeat mentally and to learn quickly those things which he likes, and correspondingly he tends to learn slowly those things which he dislikes. It has been stated that self-activity on the part of the student is the only thing that counts in the end. If that is true, what is the essential function of the teacher? The essential function of the teacher is one of guidance, of careful setting of the stage for learning, and of the stimulation of interested effort.

In order that the students will enjoy doing worthwhile things even though they be difficult the teacher must instill in the students enthusiasm. Therefore, it is essential that an engineering teacher do something to keep himself alive.

During the first year of one's teaching experience he is usually alert and active. He is kept busy making up problems and arranging work from day to day. When he steps into the classroom that portion of the subject that he wishes to cover is fresh in his mind. The best students frequently take him off of his feet by asking unexpected and sometimes embarassing questions. All of these factors tend to make a new instructor wide awake, and as a rule, because of his being wide awake, he stimulates student efforts.

During the second year of an instructor's experience he is reasonably busy working over his material in order to better his courses. It is still necessary for him to be on his guard as unexpected and embarrassing questions may be asked by some of his students. As a result of these things the instructor is still wide awake.

* Presented at a meeting of the Kansas-Nebraska Section of the S. P. E. E., November 9–10, 1928.

As time goes on an engineering teacher will have his work well organized. The chances of the students asking unexpected questions are not great. Unless the engineering teacher has something outside of his actual teaching duties to keep him filled with enthusiasm, there is some danger that he may become stale. In short, he may get into a rut unless he takes measures to avoid it.

To avoid this possibility an engineering teacher may do one or more of several things during the school year, if his teaching load is not too heavy.

First, he may pursue post graduate work. By this it is implied that he may attend classes of advanced work. He may pursue graduate work in his own line of teaching activities or he may pursue graduate work in other branches of engineering in order to broaden his general engineering point of view.

Second, he may pursue research work.

Third, he may be able to attend faculty seminars.

Fourth, he may devote his spare time to actual engineering work, such as engineering work for companies, consulting work, etc.

During his summer vacation an engineering teacher may be able to pursue post-graduate work, or research work, he may be able to attend S. P. E. E. summer school conferences, or he may be able to do actual engineering work for companies, consulting work, etc.

Doing any one or more of the things mentioned will help an engineering teacher in keeping alive and interested in engineering work.

Even short engineering experiences of some kind are desirable. They keep an engineering teacher in touch with his subject. They help him to visualize his work. They give him confidence. With some engineering experience the instructor's judgment of essentials and nonessentials is better. Due to his engineering experience the standing of the instructor as well as that of the school is advanced.

I sent questionnaires to the deans of the three schools and they very kindly and promptly answered the questions and

returned them to me. I have combined the data that were given to me and I would like to present the results at this time.

In the three Engineering Colleges (Kansas State Agricultural College, Kansas University, and the University of Nebraska) there are

	Number	Per Cent of Total
Professors	40	33.3
Associate Professors	22	18.3
Assistant Professors	25	20.8
Instructors	33	27.5
Total Engineering Teachers	120	

Math., Physics, Chemistry, English, teachers are not included.

During the last summer vacation engineering work as a profession was carried on (outside of teaching) by

	Number	Per Cent of Same Rank
Professors	13	32.5
Associate Professors	8	36.3
Assistant Professors	8	32.0
Instructors	18	54.6
Total Engineering Teachers	47	39.2

During the last summer vacation post graduate work, staff seminar, or research (either with or without formal credit) was pursued by

	Number	Per Cent of Same Rank
Professors	7	17.5
Associate Professors	6	27.3
Assistant Professors	9	36.0
Instructors	9	27.3
Total Engineering Teachers	31	25.8

During the last summer vacation an engineering company conference, an engineering conference in connection with military duties, or the S. P. E. E. summer school conference was attended by

	Number	Per Cent of Same Rank
Professors	6	15.0
Associate Professors	2	9.1
Assistant Professors	1	4.0
Instructors	0	0.0
Total Engineering Teachers	9	7.5

This semester engineering work as a profession is being carried on (outside of teaching) by

	Number	Per Cent of Same Rank
Professors	10	25.0
Associate Professors	5	22.7
Assistant Professors	5	20.0
Instructors	2	6.1
Total Engineering Teachers	22	18.3

This semester post graduate work, staff seminar, or research (either with or without formal credit) is being pursued by

	Number	Per Cent of Same Rank
Professors	20	50.0
Associate Professors	11	50.0
Assistant Professors	14	56.0
Instructors	14	42.4
Total Engineering Teachers	59	49.2

I believe that one of the outstanding facts brought out by this summary is that 54.6 per cent or more than half of the engineering teachers with the rank of instructor were out doing actual engineering work last summer. In all probability the administrative officers of the engineering colleges would rather have most of the newer engineering teachers out in actual engineering work during their summer vacations than have them pursuing academic work.

It is encouraging to note that 49.2 per cent or practically half of our engineering teachers during the present semester are pursuing post graduate work, staff seminar, or research work.

The spirit of the newer generation of engineering teachers is shown in the percentages given for the instructors and assistant professors pursuing post graduate work, staff seminar, or research work this semester. 56.0 per cent of the assistant professors are pursuing post graduate work, staff seminar, or research work and 42.4 per cent of the instructors are pursuing post graduate work, staff seminar, or research work. It must be remembered that new instructors have a real job in handling their teaching load during their first year so that the figure 42.6 per cent is relatively high.

HELPING UNDERCLASSMEN IN THE CHOICE OF CAREERS

BY W. H. TIMBIE

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One of the most vexing problems, and at the same time one most necessary of solution, is how to get before the freshmen and sophomores in the technical schools sufficient information and data to enable them intelligently to choose that branch of engineering for which they are best fitted, both by intellectual attainments and natural inclination. The real reasons which influence altogether too many underclassmen in the choice of their course in a technical school are trivial in the extreme. A host of freshmen and sophomores are registered in the aeronautical departments of our colleges and universities because Lindbergh flew across the Atlantic Ocean. Many a boy is in the electrical engineering course because he has built a radio set or fixed up the family door bell. The underclassmen who have any clear idea of what is ahead of them after they graduate are so few as to be almost negligible. They have very little idea of how to get a job, or what the job would be like if they did get one; what choice there is in the work of the succeeding years, and what various routes are which lead to positions of greater responsibility. The curricula of most engineering schools during the first and second years are mainly elementary physics, chemistry and mathematics and usually identical for nearly all branches of engineering. By the end of his second year in most schools the boy must choose that branch of engineering which he wishes to make his life's work. Yet there is little, if any, material in his curriculum of the first two years which will aid him in making this decision. His schedule is already so full that such material cannot be added to the list of his regular subjects. To ask him to devote the study or recreation time of an evening to a lecture on this

subject is an unwise and unfair encroachment on the student's time.

An unusually successful solution of this difficulty has been worked out by the Electrical Engineering Department at M. I. T. The local branch of the A. I. E. E., in cooperation with the Department of Electrical Engineering, has held supper meetings on every other Friday night for the past two months. The students gather for supper at six o'clock and at 6:45 adjourn to the lecture hall, where, by means of moving pictures, lantern slides and talks by prominent engineers and executives, the conditions and opportunities existing in different branches of the electrical industry are clearly set forth. One evening is devoted to each industry. Up to the present time the following branches have been covered: transportation, electrical manufacturing, electrical communication, distribution of light and power, and the design, construction and operation of power projects. The meetings are always over by eight o'clock, although the speaker is available for personal interviews if any students wish to consult with him. The attendance at each meeting has averaged over three hundred.

By this plan a mass of information which is exceedingly hard to obtain and organize, and still more difficult to transmit by usual methods has been placed before the freshmen and sophomores interested in Electrical Engineering without adding to the classroom schedule or interfering with the evening activities.

TENTATIVE PROGRAM OF THE CONFERENCE ON MECHANICS TO BE HELD AT COLUMBUS, OHIO, JUNE, 1929

Many subjects have been suggested for discussion at the conference on mechanics in June, 1929. In the following list of questions the attempt has been made to preserve the essence of all these suggestions and at the same time to arrange them in a series of logical groups.

In formulating the questions it is assumed that students pursuing this subject will already have completed a college course in physics, and that they will have some knowledge of calculus.

It is not expected that there will be time during the 1929 conference to discuss all the questions in the list. Probably it will seem best to begin by taking up the first group. Those in attendance upon the conference will decide what topics it will be most profitable to discuss subsequently.

Group A. Objectives in the Study of Mechanics

These questions deal with the reasons why all engineering students are required to take a course in engineering mechanics. They deal specifically with the skills, or traits, or characters which it is expected that the course in mechanics will develop.

A1. Should a part of mechanics be memorized?

A2. Should definitions be memorized?

A3. Should laws and demonstrations be memorized?

A4. In addition to a memorized knowledge of the subject, what other benefits should the student derive from this study?

A5. What is the object of the solution of problems by the student?

A6. What is the relative importance of the memorized knowledge of the subject, as compared with the ability to apply its principles to the solution of practical problems?

A7. What is the object of reciting or explaining by the student of matter previously studied or problems solved?

A8. Should mathematical processes in general be given any particular attention?

A9. Should exercises be given in the mechanics course for the purpose

of furnishing review drill upon important, fundamental matters of mathematics courses previously completed?

A10. Should any attention be given to training in oral and written expression such as is supposed to be covered by the subject English?

A11. Should the course in mechanics include exercises for the purpose of securing speed?

A12. What degree of attention should be given to form and neatness in written work?

A13. What degree of accuracy in numerical results should be required?

A14. Should problems be restricted to ideal cases of simple fundamental relationships, or should they proceed as rapidly as possible to practical applications involving complex or obscure use of the laws of mechanics?

A15. What should be the relationship of the course in mechanics to the courses in physics?

Group B. Subject Matter

B1. Is it desirable to divide the subject matter into two or more classes according to the thoroughness with which it is to be mastered?

B2. For an average course covering half a year with four or five exercises per week, what should be the minimum essentials covered in statics?

B3. What should be the minimum essentials covered in kinematics?

B4. What should be the minimum essentials covered in kinetics?

Group C. Class Room Methods

C1. In presenting mechanics should we emphasize physical visualization of all the phenomena or rather mathematical symbolism and mathematical deduction?

C2. Should we work from particular and special cases to that final general law or expression, or should we work from the general case to special cases?

C3. Should statics or kinetics be taken up first?

C4. Should statics be considered a special case of kinetics, or should we try to reduce kinetics to a kind of statics?

C5. How far should the historical method, as exemplified by Mach's Science of Mechanics, be utilized?

C6. Should most emphasis be put upon theory or on applications?

C7. To what extent should the lecture method be used?

C8. What should be done about students who cannot understand the text?

C9. What kind of work and how much of it should students be expected to do outside of the class periods?

C10. What is the most desirable length of class periods?

C11. Are special computation periods desirable?

C12. Should the use of the slide rule be taught or required?

C13. Should the use of logarithms be taught or required?

C14. Is it better to discuss exhaustively a single representative problem or to take up more briefly several somewhat similar problems?

C15. Should any apparatus be used in the class room?

C16. Should definitions be memorized at the beginning or at the end of the course?

C17. What should be the nature and extent of review work?

C18. How shall we avoid giving too much help to students?

C19. What is the most efficient way of handling the class periods?

C20. What is the best method of handling problem work?

Group D. Examination and Marking Systems; Standards of Passing

D1. What are the methods of marking and grading students in actual use?

D2. What would be the ideal method of marking and grading?

D3. What examination methods are in use?

D4. How is the standard for passing defined?

Group E. Miscellaneous Questions

E1. Is it desirable to section classes according to ability?

E2. Should the ablest students be handled in any way differently from the others?

E2. Should any particular attempt be made to correlate the course in mechanics with other courses? If so, to what extent, and how?

E4. What amount of time in the curriculum should be allotted to mechanics?

E5. What is the usual number of students in a section, and what is the optimum number?

E6. Should any library or reference work be a part of the course in mechanics?

E7. What can be done to motivate the uninterested or negligent or discouraged student?

E8. Should an instructor try to make his course popular with the students?

E9. Should an instructor teach his students how to study?

E10. Should an instructor teach his students how to use their time most efficiently?

E11. What should be the nature of the first exercise in a course?

E12. Should there be a characteristic final exercise?

E13. What should be the nature and scope of assignments of work, and when should they be made?

E14. What are the advantages and disadvantages of conducting a course without a text-book?

E15. What are the specifications for an ideal textbook?
E16. What is the best preparation for teachers of mechanics?
E17. How can the beginning teacher best be assisted?
E18. What is the best procedure for self-improvement of the teacher?
E19. What should the teacher do in the line of research?
E20. Should the same course and the same subject matter be required of all students, or should there be differentiation in accordance with the several curricula?

The committee on arrangements will welcome further suggestions regarding the program and the best plan of procedure in holding the conference.

SHERMAN M. WOODWARD,
Chairman.

IOWA CITY, IOWA

COLLEGE NOTES

University of Akron.—The institution has, at various times and under various names, offered courses in industrial engineering which have always been popular with the industries employing our cooperative students, but which have never appealed in any large measure to the students themselves. Such a course leading to the degree of Industrial Engineer was announced last year and is finding much favor with the student body. We expect to add a man next September who will head up this department and place it on a par with the other departments of civil, electrical, and mechanical engineering. Recent additions to the engineering laboratory include a 200,000 pound Olson, universal testing machine with the 20,000 pound attachment for delicate work; a Murray-Standard 30 horsepower condensing steam turbine with water dynamometer attached; a General Electric, cradle type dynamometer equipped with resistance, control panel, and instruments. Maximum capacity, 75 horsepower at 4,000 r.p.m.

The College of Mines and Engineering of the **University of Arizona** has this year an enrollment about 10 per cent greater than last year. The enrollment in Mining Engineering, however, increased 50 per cent, probably because of the fact that for a year or two the institution has been utterly unable to meet the demand for its graduates in Mining and Metallurgy.

The only changes in the faculty resulted from the resignation last year of William M. Kellogg, Assistant Professor of Electrical Engineering, who resigned to accept an industrial position. He has been replaced by Floyd Decker and W. H. Gamble as instructors in Electrical Engineering. J. S. Phelps has been added to the faculty as instructor in Mechanic Arts.

The shops of the Engineering College of the **University of Arkansas** were destroyed by fire in May of 1928. Contracts for the new buildings and orders for machinery were placed

in June, and the installation of machinery started in August. By the opening of the University on September 10, the shops were in complete operating condition and classes were started with no loss of time.

The buildings are of steel, erected on four-foot brick sidewalls with concrete floors. The building housing the machine and pattern shops is 32 by 202 feet in size, and that containing the foundry and forge shop is 28 by 153 feet. This latter building has a two story section in the center, providing a charging floor for the cupola. An outside ramp leading from the coke and iron storage gives access to this floor.

All machinery installed is of the modern high-speed type with individual drive. The large number of windows and the complete absence of overhead belts greatly simplifies the lighting problem. Besides the usual equipment the machine shop contains a 30″ Gisholt Vertical Boring and Turning Mill and a No. 3 Grand Rapids Universal Grinder. The foundry has a 30″ Crucible Furnace and a 32″ Cupola.

Professor C. H. Kent, who came to the University of Arkansas in September as head of the department of Mechanical Engineering, succeeds Professor E. L. Thearle, who resigned last spring to go to the research department of the General Electric Co. at Schenectady, N. Y.

Polytechnic Institute of Brooklyn.—The following additions have been made in the teaching staff: Lloyd F. Rader, Assistant Professor of Civil Engineering; Robert Beer, Instructor in Civil Engineering; Clifford H. F. Cottee, Instructor in Mathematics and Physics; Robert Dietzold, Instructor in Mathematics; Charles Howard Gilbert, Instructor in English and History; Henry B. Hanstein, Instructor in Electrical Engineering; Joseph A. Lambertine, Instructor in Mechanical Engineering; Daniel E. Whitford, Instructor in Mathematics.

The day registration totalled 446 on October 21 showing an increase of 21 over the registration of last year. The evening registration on the same day was 1,455 and represents 1,000 per cent increase over the registration of the first year of evening work in 1904–05. About 50 per cent of this number are qualifying for degrees in engineering and in chemistry.

Graduate courses in engineering and chemistry were augmented during the last year and now fifteen courses are offered in the four engineering curricula toward the Master's degree. The resulting registration this fall has proved conclusively the need for evening graduate work in engineering in New York City.

University of Cincinnati.—The following statistics may be of interest to the Society.

Enrollment in day classes in Engineering and Commerce:

Men	1,472
Women	56
Total	1,528

of which 1,296 are in Engineering and 332 in Commerce. Our largest department is Electrical Engineering with an enrollment of 379.

All of these are on the cooperative basis and are employed by 258 cooperating firms.

In the evening courses, which are not cooperative, the enrollment is as follows:

Commerce	2,038
Engineering	605

Of these evening engineering students 592 are men and 13 women.

The age range in the evening students is from 17 years to 66 with the average age slightly over 25 years. About 10 per cent of the evening students are college graduates and about 23 per cent have had one or more years of college work. These figures are for total enrollment and the corresponding percentages for engineering students would undoubtedly be higher than the averages for the entire group.

Colorado Agricultural College.—Changes in faculty: Associate Professor Carl T. Almquist in department of electrical engineering, resigned and Dr. Fred L. Poole has been ap-

pointed to take his place. These are the only changes in the faculty in the department of Engineering.

Enrollment of engineering students for the fall semester 1928–29, 291, a very substantial increase over former years.

There has been added to our equipment new machinery, notably a new cupola in the foundry, new sawbench for the pattern shop. A friction testing machine for the M. E. Laboratory; several electrical engineering machines and instruments in the electrical engineering laboratory, and in the civil engineering department new surveying instruments have been purchased during the year.

The Cooper Union.—At the beginning of the current school term, Dr. Albert B. Newman was appointed as Head of the Department of Chemical Engineering.

For a number of years there have been established at The Cooper Union well coordinated courses in Civil, Electrical, and Mechanical Engineering. However, it was only four years ago that the Course in Industrial Chemistry was modified into one in Chemical Engineering, and Dr. Newman, late research engineer with the General Chemical Company of New York, has been brought in to take charge of its development.

Dr. Newman comes to us well equipped, and is a graduate of the Chemical Engineering course of the University of Michigan, Class of 1911. In 1925, after some fifteen years' work in chemical engineering, management and research, he uniquely had the opportunity of returning to his alma mater for post-graduate study, and was awarded his Doctorate in 1928.

We look forward with much pleasure to the development of our course in Chemical Engineering under the able leadership of its new head.

Ecole Polytechnique de Montréal.—This School of Engineering offers a five-year course in general engineering with an option in the fourth and fifth years in Chemical Engineering. All lectures are given in French although a good many English and American textbooks are used specially in the ap-

plied science subjects. This staff is composed of thirty professors and lecturers. Fifteen to twenty-five students graduate each year. The enrollment totalled this year 197.

Iowa State College.—Anson Marston, Dean of Engineering, was elected President of the Association of Land Grant Colleges and Universities at the regular annual meeting in Washington on November 20, 21, and 22. He has also been elected President of the American Society of Civil Engineers for 1929.

The engineering enrollment at Iowa State College for the fall of 1928 shows an increase of about 50 students over 1927. Increases were noticeable in Chemical Engineering, General Engineering, and Mechanical Engineering. Electrical Engineering showed some decrease.

The third meeting of the Advisory Board on the Cooperation between Iowa industries and Iowa State College was held December 6 in Des Moines, Iowa. This Board was formed in February 1927.

A number of the Engineering Faculty have spent considerable time since last summer studying the questionnaires sent to the college by the Land Grant College Association, in cooperation with the United States Bureau of Education. Two main questionnaires have been received by the engineering division, one on research and graduate work, and the other on under-graduate engineering education.

The 1929–30 Iowa State College catalog will include a new group of courses dealing with Aeronautical Engineering. A total of six courses have been added to the Mechanical Engineering curricula and an optional sequency is now provided for senior students.

University of Iowa.—The College of Engineering showed a larger increase in attendance than usual this year, 25 per cent in the freshman class and 12 per cent in the total enrollment. The Mechanical Engineering Department registered the largest gain.

The new hydraulics laboratory has been finished at the west end of the University power dam across Iowa river and will

be used with temporary heating facilities during the second semester. The new tilting tank is being installed and will afford unusual facilities in the investigation of river hydraulics. The experimental channel, which is at present 10x10 ft. by 190 ft., will probably be extended next year about 200 feet farther down stream. With the unfailing quantity of water and the 9 ft. head on the dam, this channel affords means of large scale channel experimentation. Two river studies are now being planned for Iowa streams.

The new power and heating plant is now being completed. Prof. B. P. Fleming, head of the M. E. Department, who had charge of the design provided for the utilization of the plant in class and experimental work. The plant is located on the Iowa river at the power dam opposite the new hydraulics laboratory and includes the hydro-electric unit as well as the steam plant.

New courses in industrial engineering and in aeronautics have recently been added, and a public utilities option in the electrical engineering curriculum has been provided.

Owing to the absence of Professor A. H. Ford because of illness, J. T. Rood, on leave from the Wisconsin faculty, is acting as head of the Electrical Engineering department for the year. R. M. Barnes was appointed assistant professor of industrial engineering; F. T. Mavis, assistant professor of mechanics and hydraulics; A. P. Strom, assistant professor of electrical engineering and R. R. Whipple, instructor in electrical engineering.

The department of mechanics has completed installing a new 200,000 pound Olsen testing machine which will accommodate a 10 ft. tensile or compression specimen and a 16 ft. transverse specimen.

The electrical engineering department is equipping a meters and standards laboratory.

Three interesting and promising developments have come from the M. E. laboratories within the past year; a successful rotary sleeve valve gasoline engine, invented by E. A. Putnam, assistant in the department; a gyroscopic accelerometer for measuring quantitatively the riding qualities of automobiles

and other vehicles; a fan humidifier for use in heating and ventilating rooms, invented by Assistant Professor M. L. Fox.

The athletic association is preparing plans for the erection of a new stadium of 42,000 capacity this summer. The all steel structure invented by B. J. Lambert, head of the department of civil engineering, has been adopted because of its low cost, durability and convenience.

The department of chemical engineering has installed a new osmose machine of German invention, which removes soluble salts and yields 250 gallons of salt free water per hour at a much less cost than distillation.

The new four and one half million dollar medical building and hospital were dedicated last November. The new hospital is modern in all its facilities and contains 750 beds. This makes a total provision for 1,000 in the three hospitals, the new general, the children's and the psychopathic. The new general hospital is approximately 300 by 500 feet in plan and on all five floors contains about seven acres of floor space. The new facilities were built from funds provided jointly by the State and by the Rockefeller Foundation. By law, indigent patients from the entire state are treated in this hospital at the expense of their respective counties.

University of Kentucky.—Mr. Percy H. Johnston, President of the Chemical National Bank of New York, has endowed a research laboratory in connection with the College of Engineering, for the purpose of carrying on research on the effect of sunlight on plants and animals in connection with the atmospheric comfort zone established under the direction of Dean F. Paul Anderson, when he was the Director of the Research Laboratory of the American Society of Heating and Ventilating Engineers in cooperation with the United States Bureau of Mines at Pittsburgh and the United States Public Health Service. During the years 1921 to 1924 there was developed in the Research Laboratory of the American Society of Heating and Ventilating Engineers located at the Bureau of Mines in Pittsburgh, Pennsylvania, what is known as the atmospheric comfort zone for human beings, an idealism

in atmospheric air conditions that will produce the greatest comfort to human beings and therefore the greatest health and therefore the greatest longevity.

The sun of our solar system is the source of all our energies. It comes to human beings in a secondary way through foods but it is proposed in this research to study the direct effect on plants and animals of the sun's energies through the determination of the influences of ultra-violet rays of light on life. The ordinary glass used in most living and work quarters cuts out practically all of the ultra-violet rays. In recent years a number of glass mediums have been given to man that will allow from twenty to forty per cent of the ultra-violet rays to pass through. In the research laboratory established by Mr. Johnston the problem for developing new mediums for allowing the passage of ultra-violet rays is contemplated. With an air curtain practically all of the ultra-violet rays pass into a heated room from the cold outside and one of the approaches will be to develop a form of air curtain that can be adapted for general use.

In this new laboratory established at the University of Kentucky rooms will be provided with a great variation in degrees of temperature and humidity which will be controlled automatically throughout the twenty-four hours of the day. The value of artificial sunlight will also be studied. Various lighting devices will be tested for their ultra-violet ray production qualities. In this laboratory will be housed a great variety of plants, growing in various degrees of temperature and humidity. There will also be under observation a wide range of animals, including human beings.

This whole investigation points to a determination, if possible, of what is the ideal condition of atmospheric air and light that will give to man the greatest amount of energy-giving qualities of air and light. In all probability human beings at work and play in the near future will be in environments that embody these idealisms.

Civilization will be under lasting obligations to Mr. Johnston in making it possible to solve some of the problems effecting the health and longevity of humans.

This research will be under the direction of Dean F. Paul Anderson of the University of Kentucky and his corps of assistants.

Lafayette College.—Professor E. H. Rockwell, formerly Dean of the Engineering School of Rutgers University, has succeeded Professor F. O. Dufour as head of the Civil Engineering Department at Lafayette College.

Other new members of the engineering faculty at Lafayette are:

Cabeen, C. K., Instructor in Geology,
Hart, W. F., Instructor in Chemistry,
Linner, E. R., Instructor in Chemistry,
Roehrig, G. F., Instructor in Civil Engineering,
Smith, F. W., Instructor in Electrical Engineering.

Construction of the John Markle Mining Engineering laboratory has been started. This laboratory and recitation hall, made possible by the gift of $500,000 from John Markle, Lafayette '80, will provide very liberally for the Departments of Mining Engineering, Geology, and Metallurgy.

Plans are being prepared for a new building for the Department of Government, a gift of Mr. Fred M. Kirby of Wilkes-Barre. This building, to cost approximately $250,000, together with the Markle Building, will relieve the pressure for classroom space, which has existed for several years at Lafayette.

McGill University.—N. N. Evans, Associate Professor of Chemistry, and A. R. Roberts, Associate Professor of Mechanical Engineering, have been promoted to the rank of Professor in their respective departments.

A graduate course in Fuel Engineering is being organized in connection with the department of Mechanical Engineering. Mr. Leslie R. Thomson, who was for several years Secretary of the Lignite Utilization Board of Canada, has been appointed to direct the course with the title of Professor of Fuel Engineering.

Dr. W. W. Colpitts of the class of '99 has donated $5,000

to the Civil Engineering department to establish a graduate scholorship in honour of Dr. John Bonsall Porter, Emeritus Professor of Mining Engineering.

A new 65 H.P. Babcock and Wilcox boiler, with a working pressure of 350 lbs., has been installed in the boiler room of the Mechanical Engineering department. Extensive improvements have also been made in the Ore Dressing laboratory. Minor equipment recently added includes a new Westinghouse 62.5 H.P., 50 KVA motor generator set, a complete X-ray equipment (presented by Mr. Peter Dawson, Glasgow) and a valuable set of Johansen Blocks (presented by Mr. A. C. Tagge, President, Canada Cement Company).

University of Maine.—Following a visit by President Boardman and Dean Cloke to Swarthmore College, Honors Groups will be initiated in the Departments of Civil Engineering and Electrical Engineering beginning February 1929.

It is also planned to organize a group of juniors in the College of Technology to be given a course which possibly might be called The Outline of Man's Knowledge. This would consist of a symposium of representatives of the Departments of Astronomy, Historical Geology, Paleontology, Economics, Biology and Psychology. It would trace the development of man from the earliest times to the present day. The course was suggested by Professor Walter J. Creamer of the Department of Electrical Engineering.

Professor W. S. Evans of the Civil Engineering Department, will be on sabbatical leave from February to June, 1929.

At a faculty meeting of the College of Technology, held December 17, C. A. Dickinson, Professor of Psychology, University of Maine, gave a talk on Teaching Methods and Class Room Expedients, which he illustrated with charts and psychological tests.

Massachusetts Institute of Technology.—Professor Arthur C. Hardy, of the Physics Department, has recently perfected a recording Spectrophotometer, which automatically analyses, measures and records, to a remarkable degree of precision, the

intensity of each primary color contained in a given color sample. The instrument does not depend in any way upon the eye and requires but a few seconds to record the measurements. By it, colors may be analysed, measured and matched with precision just as easily as other physical measurements are made. This instrument has already proven to have great industrial application.

In the new Richard M. Homberg Memorial Infirmary, which was dedicated November 13, the Institute now has one of the most modern and completely equipped school infirmaries. In addition to the wards and private rooms, there is a solarium and an operating room for emergency operations. The Department of Hygiene is not only called upon for sudden and serious illnesses and accidents, but maintains a constant watch and supervision over the health habits of the student body. This is done by regular, frequent physical examinations and conferences, the purpose of the department being even more the prevention of illness and the maintenance of health, than the curing of disease.

The plan of honor groups has been recently extended to the English Department, which now offers to sophomores who have demonstrated their ability and opportunity to substitute for regular classwork in the second term, independent study on any literary or historical subject. This Honors Group is carried on by means of weekly tutorial conferences and essays and follows the adoption of this system three years ago by the Electrical Engineering Department, and more recently by the Civil Engineering Department. The experiment is in line with the present day educational tendency to give exceptional men special opportunity for individual initiative and more personal contact with members of the instructing staff.

University of Michigan.—I. New Appointments. Chemical Engineering: D. W. McCready of the Gilbert Paper Company, has been appointed Instructor in Chemical Engineering and will pay special attention to the development of courses in pulp and paper manufacture. Civil Engineering: Professor Henry E. Riggs, who has for sixteen years been Head of

the Department of Civil Engineering, was granted a two-year leave of absence, which expires in June, 1930, at which time he expects to retire from the staff of the College of Engineering; Professor L. M. Gram, for the past sixteen years professor of Structural Engineering, was appointed Head of the Department of Civil Engineering, effective on the retirement of Professor Riggs, and is serving as the Acting Head of the Department during Professor Rigg's two-year leave of absence.

Engineering Research Appointments: A. J. Herzig, Research Assistant; E. P. Partridge, Assistant Investigator; R. K. Rickett, Assistant Investigator; W. H. Sellew, Supervisor of Investigations; W. E. Sicha, Research Assistant; W. I. Truettner, Research Assistant.

Engineering Shops: Alexander Gwiazdowski was appointed Assistant Professor in Shop Practice in October, 1928. Professor Gwiazdowski will assist in Machine Shop Practice, and teach Jigs, Fixtures, and Special Tool Design, and Machine Tool Design. Marine and Aeronautical Engineering: H. C. Adams, 2d, was appointed Assistant Professor of Naval Architecture and Marine Engineering; F. N. M. Brown was appointed Assistant Professor of Aeronautical Engineering.

II. Promotions. Civil Engineering: James H. Cissel, the associate of Professor Gram in Structural Engineering, was promoted from Associate Professor to Professor of Structural Engineering. Electrical Engineering: M. B. Stout was promoted from Instructor to Assistant Professor; A. D. Moore was promoted from Assistant Professor to Associate Professor. Engineering Research: W. E. Jominy was promoted from Associate Investigator to Investigator. Marine and Aeronautical Engineering: A. F. Lindblad was promoted from Assistant Professor to Associate Professor of Naval Architecture.

III. New Buildings or Unusual New Equipment. Electrical Engineering: The Electrical Engineering Department has recently acquired a General Electric Oscillograph, complete with equipment.

IV. Significant Investigations or Research. Electrical Engineering: "Daylighting" by Prof. H. H. Higbie; "Single Phase Condenser Motors" by Prof. Benjamin F. Bailey. En-

gineering Research. The following projects have come to the attention of the Engineering Research Department during this year, for investigation and research: Natural Gasoline Association of America—Properties of Natural Gasoline as a Component of Motor Fuel (Renewal). Michigan Gas Association—Manufacture and Utilization of Manufactured Gas (Renewal). Mechanical Engineering. Following considerable testing regarding the painting of radiators, Professor C. H. Fessenden and Professor Axel Marin have published "The Effect of Surface Paints on Radiator Performance" in the December, 1928, issue of the Journal of American Society of Heating and Ventilating Engineers.

V. Miscellaneous. Chemical Engineering: A new bulletin descriptive of the graduate courses in general Chemical Engineering, Metallurgical Engineering, Gas Engineering and Organic Chemical Industries, has just been issued by the Department of Chemical Engineering. There are forty-one graduate students enrolled in this work during the present year, twenty-two of whom already have their Master's degree and are proceeding to the Doctorate. Alfred H. White has been elected President of the American Institute of Chemical Engineers for the year 1929. Professor W. L. Badger has been elected as Director of the same society for a three-year term. Civil Engineering: The Board of Regents approved the expenditure of thirty thousand dollars for books, periodicals, etc., to equip more completely the Transportation Library which has been in process of formation under Professor John S. Worley.

The University of Nebraska.—Professor Oscar W. Sjogren, Chairman of the Department of Agricultural Engineering, has been granted a leave of absence for a term of one year, beginning February 1, 1929. During his absence from the University he will be working with the Killefer Mfg. Corp'n., of Los Angeles, makers of tillage and road tools. He will be an extension and contact man and will visit various parts of the United States and Canada, making special studies of tillage and tillage machines.

Professor E. E. Brackett will act as Chairman of the Department of Agricultural Engineering during the absence of Professor Sjogren.

Edward Anderson, formerly with the Department of Mechanical Engineering, University of Wisconsin, has become Assistant Professor of Mechanical Engineering at the University of Nebraska. His work will be in the field of thermodynamics, metallography, and heat treatment of metals.

Mr. D. H. Harkness is a newly appointed instructor in Civil Engineering. He comes to us from the Division of Architecture, Department of Public Works, State of New York. He is a 1926 graduate of the Rensselaer Polytechnic Institute.

Newark College of Engineering.—The college opened this year with an enrollment of 326 regular engineering students.

Additions to faculty comprise Mr. Robert B. Rice, Assistant Professor in Mechanical Engineering; Mr. Herman C. Hesse, Instructor in Department of Mathematics; Mr. M. H. Merry, Assistant Professor of Civil Engineering; Mr. Ralph B. Smith, Instructor in Chemistry; Mr. Robert Widdop, Instructor in Mechanical Drawing.

Word was received late in October of the Charles T. Main award granted to Mr. Robert M. Meyer of the Class of 1928 by the American Society of Mechanical Engineers for the best student paper written. As this college has prided itself particularly upon the professional standing of its students rather than their athletic standing, this national award has meant much.

In November, Director Cullimore called a meeting of the faculty members of the S. P. E. E. A petition * was forwarded to the Society for a Section Charter. Professor F. N. Entwisle, Professor of Physics, Princeton '09, was elected Chairman, and Mr. Douglas Baker, Instructor in Mechanical Engineering, Stevens Institute of Technology 1915, was elected Secretary. The feeling was expressed that there should be some definite understanding among schools furnishing cooperative education as to a minimum academic content in the co-

* *Editor's Note:* This petition has been approved.

operative courses. It was strongly felt and urged that cooperative schools, particularly in this locality, offer an academic content comparable with the content of any schools granting a like degree. Particularly does this college feel the advisability of insisting that colleges giving "work while you learn courses" should be forced to meet certain definite minimum academic requirements.

The **New Mexico School of Mines** has an enrollment this year of 93 students. New members on the faculty are A. H. Koschmann, professor of geology and mineralogy, and V. T. Stringfield, assistant professor of geology and mineralogy. Both of these men were on the faculty of the Oklahoma Agricultural and Mechanical College the preceding year.

The old Main Building of the School of Mines was destroyed by fire on July 5, 1928. Contracts were let on December 13 for a new main building to be known as Brown Hall. This building will be completed before the opening of the 1929–30 school year. It will supply quarters for the administrative offices, department of civil engineering, and the State Bureau of Mines and Mineral Resources. The loss of the old Main Building has caused some inconvenience in conducting the educational work of the school during the current year but has not interfered with the holding of any classes.

The new Science Hall, completed in January, 1928, accommodates the departments of chemistry, physics, mathematics, and English. It also contains the general assembly room of the school. The capacity of Driscoll Hall, the main dormitory, was increased to 50 students by an addition completed in the fall of 1927.

At the beginning of the 1928–29 school year a curriculum in chemical engineering was introduced at the school. Other curricula being offered are mining engineering, metallurgical engineering, geological engineering, and general. All curricula lead to the bachelor of science degree.

North Carolina State College of A. and E.—The local chapter of the S. P. E. E. has been observing the same meeting

dates as of last year, that is the third Monday in October, November, January, February, April, and May.

The officers for the year are Thos. P. Harrison, Chairman, C. L. Mann, Vice-Chairman, L. E. Wooten, Secretary, R. P. Kolb, Treasurer, and A. F. Greaves-Walker, Chairman of the Program Committee.

The largest undertaking for the year, perhaps, is an attempt to acquaint the high-school principals and teachers of the state with the college-entrance requirements, and the necessity of more thorough preparation in fundamentals prerequisite to the engineering curricula.

A new building housing the Department of Civil Engineering and the Engineering Experiment Station was recently completed. Besides the usual class rooms and offices, there are included a department library and reading rooms, and an adequately equipped laboratory suited to the needs of civil and highway engineering.

A new building for School of Science and Business has also recently been completed.

Holladay Hall, the first building of the college to be erected, is being completely renovated, all the administration offices being temporarily in other buildings.

In the School of Engineering, R. S. Fouraker and W. D. Johnson were added to the faculty to fill the vacancies caused by the resignation of Professor C. W. Ricker, and Mr. J. S. Arbuckle. J. M. Edwards was appointed instructor in mechanical drawing.

The School of Education was authorized by the Board of Trustees last June. This is the sixth school to be organized, the others already having been in operation are as follows: Engineering, Agriculture, Science and Business, Textile, and Graduate.

The College enrollment during the fall term 1928 was 1646, 680 of these being in the School of Engineering.

The Pennsylvania State College.—The department of Industrial Engineering has been dividing its freshmen into three sections, according to ability. Tests are given each week

and the students are moved up or down accordingly. The instructors are also rotated so that each section has experience with each of the three instructors.

In the department of Electrical Engineering, especially capable seniors are given special instruction in the field of investigation in advance of the requirements for the majority of the students. This method of providing special instruction for able students has been followed for some time with satisfactory results.

University of Pittsburgh.—John A. Dent, formerly of the University of Kansas has been appointed professor and head of the Department of Mechanical Engineering.

H. E. Dyche, head of the department of Electrical Engineering, is chairman of the Pittsburgh Section of the A. I. E. E. On Tuesday, January 8, a joint meeting was held in Pittsburgh of the student branches of the society from the University of West Virginia, Carnegie Institute of Technology and the University of Pittsburgh. The students were guests of the Westinghouse Electric and Manufacturing Co. at a luncheon, and spent the afternoon at the Company's plant at East Pittsburgh.

This year regular members of the faculty of the School are conducting the freshman and sophomore classes in engineering subjects at the junior college centers at Johnstown, Uniontown and Erie, Pa. At Johnstown, a laboratory suitable for the elementary electrical engineering courses has been equipped and surveying equipment has been purchased.

The decision was reached last year to make Camp Hamilton, the summer surveying and hydraulics camp of the schools, a permanent camp. A five-year program has been projected which includes each year the construction of permanent cottages and service buildings, until at the end of the period a permanent camp will have been completed. Camp Hamilton is located in the Allegheny Mountains, about six miles from Winber, Pa., and about 90 miles east of Pittsburgh.

Roswell Johnson, head of the oil and gas department, has this year instituted in the downtown division of the Univer-

sity, courses in oil and gas production, open to those actively engaged in the oil and gas industry.

The downtown division night school course in public utility engineering, instituted three years ago, has continued its initial success. At the present time, about 80 men are enrolled for the work of the first three years. The course is six years in length.

The graduate courses in engineering held in cooperation with the Westinghouse Electric and Manufacturing Co., have an enrollment of about 150 men. The initial class in the work will receive their Masters' degrees at the coming June Commencement.

Pratt Institute.—Three more members have been appointed to the faculty of the school for Science and Technology, thus making a total of five new members for the present school year. Two of these appointments are because of an increased enrollment. Mr. John Stockman, a graduate of the University of Pennsylvania and for the past three years combustion and test engineer for the American Engineering Company, Philadelphia, has been added to the department of Physical Elements of Engineering. Mr. N. P. Kernahan and Mr. William Finnan are temporarily filling vacancies in the Department of Machine Shop and Foundry Practice occasioned by the resignations of Mr. H. E. Blount and Mr. P. P. Miller.

The School has 461 students enrolled in its three engineering courses, namely, Industrial Mechanical Engineering, Industrial Electrical Engineering and Industrial Chemical Engineering.

The new Engineering Building, which will constitute another unit in the building plan of the School, is rapidly nearing completion and will be ready for occupancy sometime in the spring It is a four story building 180 feet by 60 feet, and will provide a commodious design and drafting room on the top floor, Electrical laboratories on the third floor, executive offices and class rooms on the second floor and Mechanical laboratories on the first floor The new building is being erected at a projected cost of about $350,000.00 and will give

to the School of Science and Technology many improvements in its teaching facilities and important betterments for its particular type of engineering education.

Princeton University.—The new Engineering Building was dedicated on Thursday, November 15, with representatives from many universities, colleges and schools of engineering.

The building contains classrooms, drawing rooms and laboratories for mechanical engineering, hydraulics and electrical engineering. The work in concrete, road materials and cement will be cared for in a small two-story structure. Other material testing and industrial chemistry will be cared for in the present chemical laboratory. It is believed that the new laboratories will be installed during the summer of 1929.

The dedication exercises included the presentation of the building by the architect, Charles Z. Klauder, to President John Grier Hibben who spoke on the aims of the modern engineer. Dean Arthur M. Greene, Jr., spoke on the Princeton Engineering School.

At the luncheon following the dedication Mr. Carlton S. Proctor of New York City, spoke on the Princeton Engineering Association, and Dean Augustus Trowbridge of the Graduate School of Princeton University spoke on Science and Engineering. Dean Dexter S. Kimball of Cornell University spoke on engineering and industry.

The ladies of the Engineering Department served tea in the late afternoon after the dedication of the building.

Purdue University.—The new members of the engineering staff include the following: Chemical Engineering: James T. Gow, Instructor, A. J. Hoskin, Associate. Civil Engineering: M. Daniloff, Instructor, E. M. Loebs, Instructor. Electrical Engineering: L. E. Beck, Instructor, J. H. Bowman, Instructor, E. M. Sabbagh, Assistant. Mechanical Engineering: W. T. Miller, Instructor. Practical Mechanics: Edgar Ainslie, Instructor, J. H. Porsch, Instructor, F. W. Bollman, Assistant, J. Rees, Assistant. Engineering Experiment Station: H. H. Lurie, Assistant, W. F. Herald, Assistant, Charles G. Dryer, Fellow, Marshall Brown, Fellow.

The enrollment figures on November 1, 1928 were as follows:

Chemical Engineering	272
Civil Engineering	566
Electrical Engineering	777
Mechanical Engineering	774
Industrial	13
Graduate Students	35
Total	2437

Plans are being drawn for new mechanical engineering and chemistry buildings It is hoped that these will be started next spring.

Investigations in the Purdue University Engineering Experiment Station in cooperation with railroads, industries and utilities require the time of nearly one hundred full time research men and involve an expenditure of nearly $300,000.

Rensselaer Polytechnic Institute.—The new hall and library building (Amos Eaton Hall) finished during the past summer has been used during the present term and has proved very satisfactory. The hall finished in time for Commencement Exercises and the library was installed in August and September. Bookstacks have been provided for probably ten years in the future, and there is additional room for stacks providing for perhaps the next fifty years. The reading room will seat nearly three hundred students.

The last number of the Engineering and Science Series—A Study of the Production of Chromium Surfaces for Retarding the Corrosion of Nickel at High Temperatures—has just appeared. The next issue, which will be a very interesting one, will be "Thermal Conductivity of Copper and Nickel and some Alloys of Nickel."

Dr. Robb, Head of the Department of Electrical Engineering, has arranged for an interesting electrical exhibit to take place in Russell Sage Laboratory during the last part of January. Almost all of the apparatus in the Electrical Engineering Department will be used in this exhibit, and the laboratories will be open to the public. Special electrical exhibits

will be arranged; for instance, one room will be fitted up with all electrical appliances now used in homes. There will be other similar special exhibits.

Rhode Island State College is this year enjoying an important addition to its physical plant in the form of three new buildings.

Bliss Hall, a three-story building of fire-proof construction, offers a new home for the Department of Engineering. With the exception of space reserved for offices, the basement and first floor are devoted to shop and laboratory facilities. The second and third floors are given over to lecture and drafting rooms, a departmental library and an engineering museum. The building is particularly well lighted, is provided with the Dunham Differential System of heating, and with elaborate means for artificial ventilation. Its occupancy makes possible, and has already been met by a very considerable increase in the enrollment of engineering students.

Edwards Hall provides for new quarters for the College Library and contains a fine auditorium with a seating capacity of one thousand. No pains have been spared in making this building an ornament to the Campus and at the same time a place of real service to the college community.

Hammond Hall, the third of the group of new buildings, is designed to meet the combined needs of Armory and Gymnasium.

All three structures were built from the proceeds of a state bond issue authorized by popular vote at the state election of two years ago. This provision for the present and future needs of the college, made possible by a very large majority in a popular referendum, is looked upon as a most significant endorsement by the people of the state of the work carried on by the institution and an evidence of their appreciation of its past accomplishments.

On account of the serious illness with which he was taken shortly before the opening of the fall term, Profesor Webster, head of the Department of Civil Engineering, has been forced to relinquish his usual duties during the past semester. During

his absence the work of the department has been carried on by Professor James R. Randolph, who came to Rhode Island on temporary appointment for this purpose.

We are pleased to report that Professor Webster's health is greatly improved and that it is expected that he will be able to resume his regular duties at the opening of the next semester.

In view of the growth of the department, Profesor Randolph has consented to extend his engagement, and he will remain as a permanent member of the engineering staff.

Rutgers University.—Dean Edward H. Rockwell resigned in June 1928 to accept the position of Professor of Civil Engineering in Lafayette College. Professor R. C. H. Heck (Mechanical Engineering) is acting as Dean of the Engineering College for the current year. Fred H. Pumphrey from State University of Iowa, has been appointed Professor of Electrical Engineering. Harold D. Hatfield from Howard University, Washington, D. C., has been appointed Professor of Industrial Engineering and for the time being is functioning as a member of the Department of Mechanical Engineering.

Sheffield Scientific School of Yale University.—New Appointment: Mr. Elliott Dunlap Smith, formerly Division Manager for the Dennison Manufacturing Company, has been appointed Professor of Industrial Engineering. Professor Smith will devote himself particularly to instruction and research in the field of personnel. Promotions: Mr. Herbert Lee Seward has been promoted to be Professor of Mechanical Engineering. Professor Seward has charge of the courses in Mechanical Engineering for Industrial Engineering students and teaches the Senior engineering course dealing with plant organization and management. He also offers work in Graphical Computations and Marine Engineering. He serves as expert on fuel conservation for the United States Shipping Board and is actively engaged in investigatory work in this field.

Mr. Walter J. Wohlenberg has been promoted to be Professor of Mechanical Engineering. He has charge of all advanced

instruction in power engineering and is engaged in research work on problems of furnace temperation, radiation, and energy liberation in the burning of pulverized fuel, in which field he has won international recognition.

The **South Dakota State School of Mines** has enjoyed a very unusual growth since the close of the World War. An enrollment of 333 students this fall gives a 50 per cent increase in the past four years, a 30 per cent increase in the past two, and 13 per cent over last year. The accompanying diagram gives, graphically, the rate of growth.

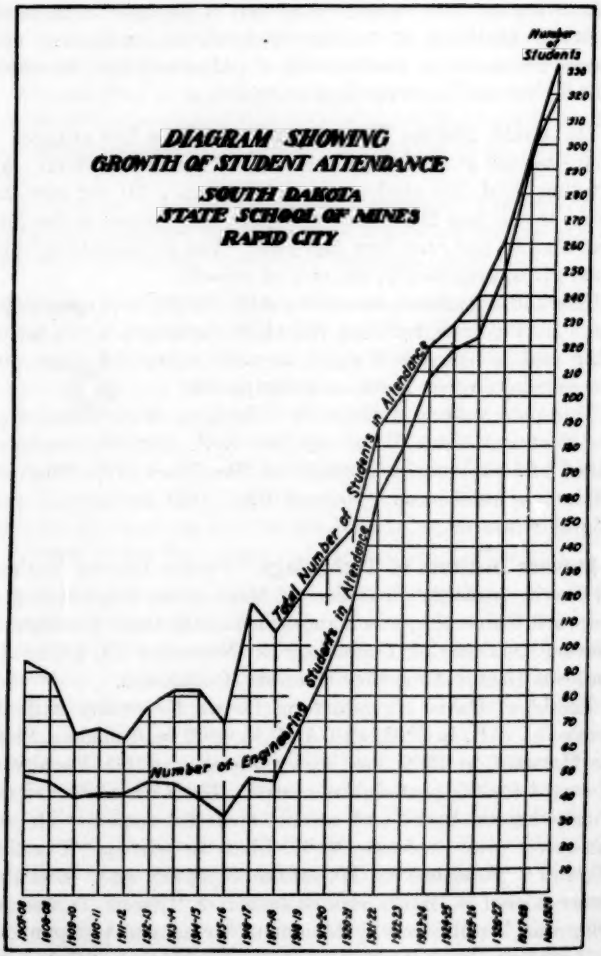
This fall a gymnasium costing $125,000.00, was opened for use. It is a brick building 102'x102' containing a tile swimming pool, a basket ball court, an auditorium and stage, and the necessary other rooms and equipment.

This past year a Bulletin on "Tertiary Mineralization of the Northern Black Hills" by Dr. J. P. Connolly was published and the quarterly magazine The Black Hills Engineer put out a number on "Natural Gas" that has created considerable interest.

Stevens Institute of Technology.—Doctor Harvey Nathaniel Davis, formerly Professor of Mechanical Engineering at Harvard University, was inaugurated as the third president of Stevens Institute of Technology on November 23, 1928. He succeeds Doctor Alexander Crombie Humphreys.

President Davis, a graduate of Brown University with the degree of A.B. in 1901, and A.M. in 1902, and made a Ph.D. by Harvard in 1906, has been a member of the Faculty at Harvard for the past eighteen years. He is the author of two widely known books and several technical papers. He collaborated with Professor N. H. Black in writing "Practical Physics," published by Macmillan Company and, with Professor Lionel S. Marks was co-author of "Steam Tables and Diagrams," published by Longmans Green and Company.

President Davis is a Fellow of the American Association for the Advancement of Science; Life Member of the American Mathematical Society; Fellow of the American Physical Society; Fellow of the American Academy of Arts and Sciences;



Increase in attendance over last year	13 per cent
Increase in attendance over 2 years ago	30 per cent
Increase in attendance over 4 years ago	50 per cent
Total enrollment to November 1, 1928	333

Member of the Washington Academy of Sciences and Member of the American Society of Mechanical Engineers.

At various times, President Davis has been associated with the General Electric Company; the U. S. Air Service; Franklin Railway Supplies Company; U. S. Bureau of Mines; Air Reduction Company, etc.

The inauguration ceremonies of November 22 and 23, 1928, opened with a dinner to delegates of other institutions at the Hotel Astor in New York City, on November 22. Speakers on this occasion were President W. H. P. Faunce of Brown University; President Lotus D. Coffman, University of Minnesota; Edward C. Elliott, President of Purdue University; President Palmer C. Ricketts, of Rensselaer Polytechnic Institute; President John M. Thomas of Rutgers University and Doctor Henry Suzzallo.

At a scientific session in the auditorium of the college on the morning of November 23, papers were read by Dr. John Johnston, Research Director of the United States Steel Corporation and Doctor Robert A. Millikan of the California Institute of Technology. Doctor David S. Jacoby, Trustee of the college, and former president of the American Society of Mechanical Engineers, presided.

Following the scientific session, a memorial tablet to the late President Humphreys was unveiled; the Stevens Engineering Museum was opened to the public; and a replica of the John Stevens Locomotive of 1825, constructed by the Pennsylvania Railroad, was operated on the campus near the site where it originally ran 103 years ago. This was the first locomotive successfully run under steam on tracks in America.

President A. Lawrence Lowell of Harvard and President Davis spoke at the inauguration ceremonies in the William Hall Walker Gymnasium. President Davis in his inaugural address recommended a single, unspecialized curriculum in engineering education, with emphasis on "basic disciplines that underlie all engineering careers."

At Stevens Institute of Technology a distinction has been made in the function of the Office of the President, in order to relieve the President of many of the administrative duties

which are usually included in his responsibilities. The Trustees of the college have selected a Vice President and a Treasurer in the person of Mr. James Creese, formerly Secretary of the American Scandinavian Foundation. Mr. Creese is a graduate of Princeton University, where he also received his M.A. degree. While at the Scandinavian Foundation he introduced the program of industrial fellowships or work for students, which has now been extended by other organizations to provide for a number of foreign students coming to the United States for practical study of industry.

At the opening of his administration, President Harvey Nathaniel Davis of Stevens Institute of Technology announced several changes in the administrative staff of the college.

Professor F. deR. Furman, head of the Department of Machine Design, was named Dean of the college and Professor John C. Wegle, Assistant Dean. Professor Furman has been associated with the Faculty of the Institute since his graduation there in 1893. He edited, in 1905, the Morton Memorial Volume, published as a tribute to Doctor Henry Morton, the first president of the college. Professor Wegle was also designated Registrar to succeed Professor Adam Riesenberger who retired.

Mr. William Duane Ennis, Director of Research, of the Technical Advisory Corporation of New York City, has been appointed Lecturer in the Economics of Engineering at Stevens Institute. Mr. Ennis is a specialist in industrial management and has been connected with the Walworth Company, American Linseed Company, and the American Locomotive Company. He has also served as professor of mechanical engineering in the post-graduate department of the United States Naval Academy and other technical institutions. During the war he held the rank of Major in the Ordinance Department and served as technical advisor to the War Claims Board 1919–20. He recently has been engaged in economic surveys of the city of Cincinnati, the city of Utica, and the Mohawk Valley, and the Port of Mobile, Ala. At present he is directing an economic survey of the State of Virginia under the

auspices of the Virginia State Chamber of Commerce. Mr. Ennis is a graduate of Stevens.

Mr. William Allen Shoudy, consulting engineer and associate professor in mechanical engineering in Columbia University has also been appointed Lecturer in Economics of Engineering. Mr. Shoudy has been associated with the Fuller Cotton Machine Company, the Oxnard Construction Company, the Harrison Safety Boiler Works, and the D'Olier Engineering Company.

Mr. Joseph H. Keenan, a graduate in naval architecture of the Massachusetts Institute of Technology, is appointed assistant professor in mechanical engineering. Mr. Keenan has been engaged in research and development work on steam turbines at the Schenectady plant of the General Electric Company. He has lately completed a new chart of the thermal properties of steam, which was presented at the anual meeting of the American Society of Mechanical Engineers.

Swarthmore College.—Changes in faculty: Arthur J. Rawson, Instructor in Mechanical Engineering; William S. La Londe, Jr., Instructor in Civil Engineering; N. H. Winde, formerly Instructor in Civil Engineering, is now with the E. I. Du Pont Company; Andrew Simpson, formerly Assistant Professor of Mechanical Engineering, is on leave for the year to act as Resident Engineer, Swarthmore College.

New Equipment: In the Electrical Laboratory: 3 unit sine wave set, consisting of D.C. motor driving two 7.5 K.W. generators, manufactured by the General Electric Company. In the Mechanical Laboratory: 2 York refrigerating machines of the ammonia compression type. 5 airplane engines from the U. S. Government: Liberty 12, Packard 1151A, Union 6, Wright H 3—Hispani type, Lawrence 3 cylinder radial.

The enrollment for the year 1928–29 is 57 students.

Syracuse University.—Total enrollment for 1928–9 is 353 students—145 of whom are members of the Freshman class. With the exception of two years during the war, this is the largest enrollment we have had in 19 years.

Harold W. Hobbs, formerly Instructor in Civil Engineering

and Drawing, resigned in June, 1928, to accept a position with the Intercepting Sewer Board of the City of Syracuse, N. Y. His place was filled by the appointment of Mr. David M. MacAlpine, C.E., South Dakota School of Mines.

Prof. Gerard M. Edell, of the Department of Chemical Engineering, will spend a six months' leave of absence, beginning in February, at the Columbia University in New York City, where he will study for his Doctor's degree.

The Faculty have completed a two-year study of curricula by making revisions which discontinue some of the subjects previously given and by including electives in the course. The amount of time given to the basic studies in mathematics, physics, drawing, etc., has not been reduced. The program for shopwork has been modified and the content of the other courses examined and revised.

The University of the City of Toledo.—The voters of Toledo, Ohio, recently approved a bond issue of $2,850,000 for a new university for the City of Toledo. This bond issue will be used for relocating the University, new buildings and equipment.

A number of probable sites are now under consideration by President Henry J. Doermann and a committee of the Board of Directors, and a decision will be made as to the new location around the first of the year.

New members of the faculty this year as given as follows: Adolph Schumacher, Ph.D., Assistant Professor of Latin; Edward J. Lorenz, Ph.D., Assistant Professor of Physics; Harold G. Oddy, Ph.D., Instructor in Chemistry; Nelson Hovey, A.B., Teaching Fellow in Chemistry Leland Overman, A.B., A.M., Instructor in Social Studies.

Tulane University.—C. W. Ricker, formerly of Massachusetts Institute of Technology, and late of the North Carolina State College, has been appointed to a professorship in Electrical Engineering. Gilbert H. Dunstan of the State University of Iowa, has been appointed Assistant Professor in Mathematics. C. G. Jaeger, late of the University of Missouri, has been appointed Assistant Professor of Mathematics.

At the summer meeting of the Board of Administrators an appropriation of $50,000.00 was voted for the purpose of making additions to the equipment of the several Engineering Laboratories. A portion of this fund is now being expended for extensive additions to the Electrical Engineering Laboratory.

The enrollment for the session 1928–29 is 279. The combined course in Mechanical-Electrical Engineering continues to attract the larger number of students, there being 109 men in this course. Architecture is next with 69; Civil Engineering 58 and Chemical Engineering 43.

Vanderbilt University.—Changes in Faculty: P. A. Cushman appointed Professor of Mechanical Engineering to succeed Professor J. A. Herrington, resigned.

Promotions: Wesley B. Brown, formerly Assistant Professor, to become Associate Professor of Electrical Engineering. Fred J. Lewis, formerly Associate Professor, to become Professor of Civil Engineering.

Three new buildings: Buttrick Hall, Calhoun Building and Garland Hall opened in September with opening of college, Buttrick Hall devoted to Department of Biology, Garland Hall to Physics and Geology Departments and Calhoun Building to Social Science Group.

Changes in Quarters: Civil Engineering Department moved to College and Science Halls to space formerly used by Geology and biology Departments.

Enrollment: Freshman enrollment reached limit of 250 allowed, of which 55 are in the School of Engineering.

Villanova College.—Restoration and enlargement of Mendell Hall, housing the schools of Engineering and of Science, which was almost totally destroyed by fire on January 29, 1928, will be completed in time for the opening of the second semester. The cost of this restoration, including the immediate outlay for equipment, will approximate $750,000.

At the same time, the dormitory facilities of the College have been increased by the construction of Fedigan Hall, accommodating about 135 students. This $160,000 building was dedicated at the opening of the first semester.

University of Virginia.—Faculty Promotions: James Shannon Miller, Jr., from Assistant Professor to Associate Professor of Electrical Engineering; Charles Henderson, from Assistant Professor to Associate Professor of Experimental Engineering.

Addition to Faculty: Lauren Blakely Hitchcock, recently in Explosives division of U. S. War Department, comes as Associate Professor of Chemical Engineering.

New Equipment: Additions to the meter equipment together with material for laboratory work in Communication serve to expand the facilities for testing. New engine equipment, both steam and gasoline, is to be installed during the present session.

Enrollment: An increase of approximately five per cent. in matriculation over last session is shown with a tendency for the entering students to distribute nearly equally among the major courses. A tendency for an increase in the number of students remaining for fifth-year instruction is shown.

State College of Washington.—Enrollment in strictly engineering courses, 494.

Guy E. Ingersoll succeeds Hugh M. Henton as Assistant Professor of Mining and Metallurgy.

Washington University (St. Louis).—A recently completed study of the grades of members of the graduating classes of 1926, 1927, and 1928 has led to the adoption of a regulation which distinctly raises the requirements for graduation The investigation was confined to these three classes for the reason that in September, 1925, the passing grade was changed from 60 to 70 so that the records of classes earlier than 1926 are not entirely comparable.

In determing the average grades of the 186 men who graduated in this three year period, only Junior and Senior subjects were considered. The averages were computed by weighting each grade in proportion to the corresponding number of credit hours. A condition or failure which had been made up by re-examination or by repetition was in each case considered as equivalent to a final grade of 70.

The distribution of grades is shown by the following table:

Grade	Number of Students
Over 90	7
85 to 90, inc.	32
80 to 84, inc.	57
75 to 79, inc.	72
74	10
73	0
72	4
71	3
70	1

It will be noted that 18 out of the total of 186, or almost 10 per cent, failed to reach an average of 75 per cent. In 17 of these 18 cases, conditions or failures had been imposed during the Junior and Senior years in from two to eight subjects, and the corresponding Freshman and Sophomore records likewise indicated poor scholarship.

A further examination of the records of those whose average was between 75 and 80 showed a considerable number with an unexpectedly large number of conditions in Junior and Senior subjects, 8 men having been conditioned in subjects aggregating 12 units or more of work.

The recommendation based upon these figures and adopted by the faculty, is as follows:

Each candidate for a degree must attain a weighted average grade of not less than 75 per cent in all subjects listed as part of the Junior and Senior requirements; further, he must not have acquired conditional or failing grades in Junior and Senior subjects aggregating more than 6 units of credit in the particular department in which the degree is sought, and in not more than 12 units of credit in all of them.

The **University of Wyoming** was host on December 10th and 11th to the Mining and Industrial Congress of the State of Wyoming. Among those present at this Congress were Governor Frank C. Emerson, who is a civil engineer, and a graduate of the University of Michigan, and several members of

the state cabinet, and of the Department of Commerce and Industry, and of the state legislature. During the session it was proposed by Dr. Crane, President of the University of Wyoming, to establish an Engineering Experiment Station at the University. The proposal met with very general and earnest support on the part of the Congress. During the session Governor Emerson speaking from the floor committed himself as being favorable to some of the suggestions offered in connection with this Experiment Station. One of the most important resolutions offered by the Congress was one recommending the establishment of the Station.

The proposition will go before the Board of Trustees this month and there is every likelihood that it will be presented to the legislature at its next session in January. It is little too early to make any reasonable prediction as to what success it may have before the legislature. However, if it should not be successful this time we will again bring the matter up at the next meeting of the legislature.

Wyoming has tremendous possibilities in its mineral resources. Some think that our precious metals and base metals will form an industry of considerable magnitude. Others lean to the opinion that it will be the non-metallic deposits which will assume greatest importance. One of the first jobs to be undertaken by the proposed Station is that of assembling in convenient form what is known about the geology of Wyoming. This will probably be worked out in cooperation with the Office of the State Geologist and the Department of Geology of the University. Concurrent with this problem we will engage in some more specific work in regard to our known deposits which are being worked on at present.

This year the majority of our money for equipment has gone toward the establishment of an Ore Dressing Laboratory for the mining school. Should the Experiment Station be established this equipment will be increased.